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INFANTRY SCHOOL

QUARTERLY

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FUTURE OF CLOSE COMBAT

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INFANTRY SCHOOL QUARTERLY

The latest thought on infantry
by the instructors of
The Infantry School

THE INFANTRY SCHOOL, FORT BENNING, GEORGIA

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The Future of Close Combat

Lt Col George B. Pickett, Jr., Cavalry

Note: The opinions expressed in this controversial article are those of the writer and do not reflect the thought of The Infantry School.

All of us who listen to the radio or read the paper shudder at the diabolical horrors awaiting us in the war of the future. The same was true back in the '30s when lots of us were just reaching manhood. The Sunday supplements terrified the nation with artists' conceptions of the horrors of the next war. Horrible as the war turned out to be, still, it fell far short of newspaper anticipations. Today, lurid accounts of the satanic horrors awaiting us in the ABC (atom, biological, chemical) warfare of the future must be examined for their expected effect on the battlefields of the next war.

THE ATOM

First, the "A" of the next war, the atom. At present atomic devices have not been developed into close combat weapons. The foot soldier's dream of the day when he can use the atomic bean shooters to destroy tanks is far from a reality. Possibly the atom may someday power a close combat weapon; but, until it does, the actual battlefield will not feel the atom's direct effect. And that includes the Bomb. Without a doubt it has to be considered in planning any large scale operation, but small troop concentrations in assembly areas near the enemy will not be lucrative targets for the present bomb.

BW

Probably the biggest "if" of the future is the "B"—biological warfare. There is already a precedent for the "A"

in war; but the "B" is still in the "did you hear—" stage. Any comment on how the "B" will affect close combat personnel in the next war is pure speculation. History indicates a high probability that it will be used, for whenever mankind has developed a means of destroying his fellow men, curiosity has always resulted in the new innovation being used at least once. But, when both contestants became equally adept at employing the new means, fear of retaliation in kind sometimes is a sufficient deterrent to prevent its use by either side. For example, neither side employed chemical warfare in World War II—both belligerents were thoroughly prepared to retaliate if the enemy initiated its use.

The perversity of mankind alone may result in the use of the "B" in the next war, but let us speculate a bit on its effect on the battlefield. Contaminating his own forces is a serious factor for the enemy to consider before using biological warfare as a close combat weapon. If he uses contagious germs on our close combat personnel, prisoners of war will transmit them to his own forces. Further, he will be unable to advance through the infected area without being subject to his own "bugs." If he uses rats (or other vermin and insects) to carry the bugs, they may turn on him and eat his own cheese. There are many other aspects of "B" warfare; but we are interested only in its effect on assault troops.

CHEMICAL WARFARE

Third, let us look at the "C"—chemicals. During the last war all of us were trained in anti-chemical measures. During World War I Americans were actual recipients of such attacks. The fact that the "C" was not used in World War II is no guarantee of future restrictions on its use. The "C" creates certain definite problems for the dismounted soldier. The tanker has the real advantage in this situation for he fights from a (future) gas proof compartment. One fact that may protect the dismounted soldier in the presence of the enemy is the possibility of the enemy not wanting his close combat personnel subjected to his own chemicals, since wind-borne volatile gas is no respecter of sides.

THE VT FUZE

With due apologies to ABC warfare which has not yet developed a close combat weapon, what will be the deadliest weapon to the close combat soldier in the next war? The answer is—the artillery shell with the VT fuze or an improved fuze of the VT type. It would be foolish for us to believe that we are the only modern army with the VT fuze. With this type of shell available to all armies in any future war, all foot soldiers face the problem of destruction by VT fuzed projectiles as they approach the enemy's combat positions.

DOES INDUSTRY PROVIDE A SOLUTION?

In past military events the United States has always had the benefit of superiority both in man power and industrial capacity over its enemies. But, next time, will we have both advantages? The personnel superiority appears to be on the side of our possible opponents. However, we may still have the ability to out-produce them. If we are to be outnumbered in man power, we must devise some means of conserving our close combat personnel. The old close combat doctrines of World War II will not suffice. Those teachings required us to be superior in man power at the decisive point. We can't have that decisive personnel superiority consistently if the enemy has tremendous superiority in man power; we can't consistently "get thar fustest with the mostest." If we continue to employ World War II tactics, we can expect tremendous losses from the enemy's massed artillery, firing VT fuzed ammunition, before our close combat troops are in position to assault.

These losses can be reduced by proper utilization of our industrial capacity. Our industrial machine can produce armored personnel carriers, with overhead protection from air bursts. These carriers can transport the close combat soldier from the point where he comes in range of Aggressor's massed artillery to the point where he must dismount to launch the assault. Maybe we can't transport the assault trooper onto the objective; but for every yard we transport him forward in his armored personnel carrier, we are con-

serving man power by reducing casualties. Armored personnel carriers cannot operate on the battlefield without the protection of another product of our industrial capacity —the tank. Tanks protect the personnel carriers from Aggressor tanks while the tank-carrierborne assault trooper team advances toward the objective. This procedure requires a large number of tanks; but the new U.S. type field army has over 3,000 tanks.

We gain other advantages by providing fully covered armored personnel carriers for assault troops. Think of how much more ammunition and other supplies can be carried. Think of doing away with those long, weary marches in the mud before the attack! Think of the strength of the individual soldier saved for close combat. Also look at the increased fire power of the unit afforded by the weapons mounted on the armored personnel carriers. And mobility? With these personnel carriers the assault trooper can advance at any speed he desires— from the speed of a man worming along on his belly to the full forward speed of the carrier. The carriers also enable engineers to accompany the assault troopers in the attack and also provide greater protection and mobility to supporting weapons. In the next war close combat personnel will doubtless apply the axiom, "the less time spent in crossing a fireswept area, the less chance of getting hit." Speed and violence must be utilized to the maximum.

INDUSTRIAL LIMITATIONS

Naturally there is no Utopian solution for future close combat. Many problems connected with providing armored personnel carriers for assault units remain unsolved. First there is the development problem. This is on the way to solution. The M-44 armored utility vehicle (see Figure 1) has already been developed and tested for use by armored infantry and other armored units. Although certain flaws have yet to be worked out, this vehicle can be used to transport to their assault positions personnel who fight on foot. Of course, this vehicle can and will be improved; but the significant fact is that we already have a prototype

of the vehicle for our assault trooper of the future. The second problem may be called "production, supply, spare parts, and maintenance limitations." All war industry is geared to coal and iron, of which only a portion can be allocated to armored carrier production, definitely limiting the number of armored carriers which can be produced. Another big consideration is fuel consumption by the vehicles. Remember the German tanks found out of gas on the side of the road in April 1945? Nothing wrong with them; just no fuel. Fuel consumption for such a large number of armored personnel carriers is a major supply problem on national resource allocation scale. Third, the problem of shipping this vast number of carriers to an active theater exists.

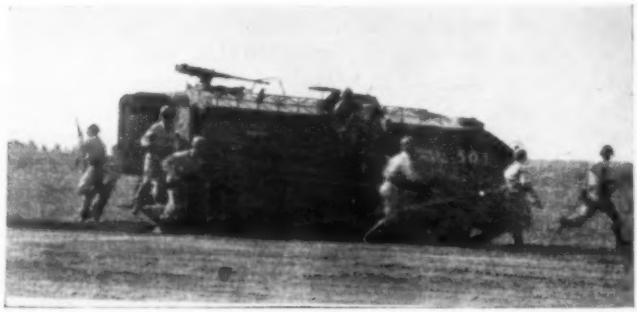


Figure 1. The M-44 armored utility vehicle.

TACTICAL UTILIZATION

With so many imposing problems, how can we best utilize the number of armored personnel carriers which can be produced and delivered to an active theater? We must provide first the carriers for the armored infantry and those other armored units which have higher priority due to their missions. The problem then becomes how best to use the remaining carriers. There are any number of solutions; but only two are considered worthy of

mention. First, it is possible to activate another type of division modeled after the German Panzer Grenadier (Armored Infantry) Division of World War II. By increasing the size of the regimental tank company of each infantry regiment to a battalion, equipping each rifle and weapons platoon with two M-44 armored utility vehicles, and providing headquarters units with carriers, we would have such a division. There are many arguments against this solution. First, it presents us with a new type unit with the usual difficulties found in training, servicing, supplying, and employing new and untried units. Also it greatly increases the logistical problems of the field army.

The second solution to the problem is to activate three "armored personnel carrier battalions" in each corps. Each "armored personnel carrier battalion" would contain enough carriers to transport an infantry regiment plus the necessary command and administrative overhead, a driver and an assistant driver for each carrier, and supply and maintenance personnel to maintain the carriers. These units would resemble an armored infantry battalion less the combat personnel. The carrier units would be available in each corps to convert any of the three infantry divisions to an armored infantry division for an attack; or in some situations regiments in different divisions could be converted to armored infantry. The presence of these carrier units in a corps would give the corps commander the ability to employ the equivalent of one armored division, one armored infantry division, and two infantry divisions. The system would not require any change in the tank strength of the infantry division since the corps commander could attach an appropriate share of the corps armored cavalry group to the division receiving the carriers. The maintenance and supply requirements for the carrier battalions would be a corps responsibility and would not overload the infantry division supply and maintenance units when these carrier units would be attached.

CONCLUSION

Serious-minded soldiers cannot lose sight of the problems to be imposed by the unknown war of the future. It

challenges us to devise a system of close combat by which a few men well equipped with the fruit of the American industrial loom can destroy large Aggressor masses with minimum loss to our force. This system should afford protection against ABC warfare and also use the killing power of machines to offset our numerical inferiority in personnel.

What about money? General Patton answered that question when he said, "Money is no object. I wish that war could be less bloody. It costs about $40,000 for a man to get killed. If we can keep him from getting killed by a few extra dollars, it is a cheap expenditure—."

More about *The Colonel's Motors* by Lt Col John T. Ewing. The tough but reasonable Colonel B. F. Finch holds a staff conference and receives a "lecture" on motors from his Motor Officer—Coming in the October QUARTERLY.

Subcaliber Firing With the 4.2-Inch Mortar

Capt James W. Kitchen, Infantry

Firing combat ammunition under field conditions is, of course, the most efficient and direct method of teaching conduct of fire. However, ammunition training allowances and range limitations often restrict such training to subcaliber firing at reduced ranges. Until recently the average heavy mortar company in the infantry regiment couldn't even conduct subcaliber firing. The Infantry School has now solved that problem with a simple subcaliber assembly that can be made by local ordnance. (See Figure 1.) A training circular on the device is now in preparation and should appear in September 1950. Use of this assembly allows efficient and concurrent training in principles of forward observation, fire direction center procedure, and crew drill.

Basically, the subcaliber assembly consists of a 60-mm mortar barrel modified to permit insertion into the 4.2-inch mortar barrel. Either the M2 60-mm barrel or the M18 barrel (with base firing mechanism) may be used. However, use of the M2 barrel is simpler and requires less modification.

The following description and accompanying specifications apply to either barrel. Additional changes required for the M19 barrel are enumerated later. The components of the assembly are *an insert, a filler block, and a filler block retriever.*

The *insert* (see Figure 2) consists of a 60-mm mortar barrel fitted with two aluminum rings which hold the 60-mm barrel snugly in the 4.2-inch barrel. Detailed specifications of these rings are given in Figure 3.

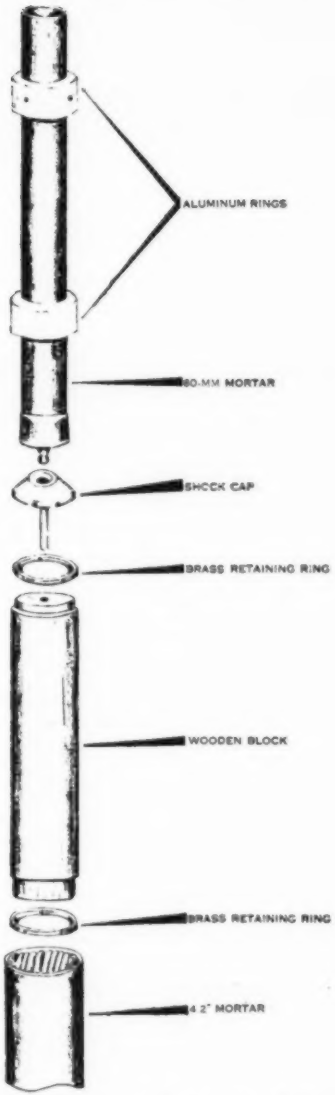


Figure 1. "Exploded" view of the parts of the 4.2-inch subcaliber device.

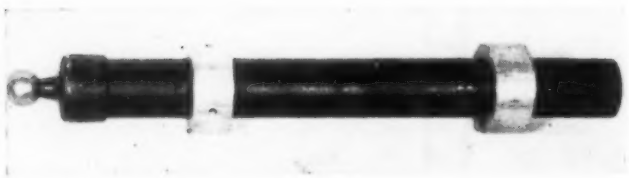


Figure 2. The insert—60-mm mortar barrel fitted with aluminum retainer rings.

The filler block (see Figures 4, 5, and 6) consists of a wooden block with two brass retaining rings around it and a steel shock cap on the upper end. The block is made of hard, straight-grained wood (oak, locust, or hickory) and is kept shellacked to prevent absorption of moisture. The brass retaining rings prevent the block from splitting. The shock cap receives the spherical projection of the 60-mm

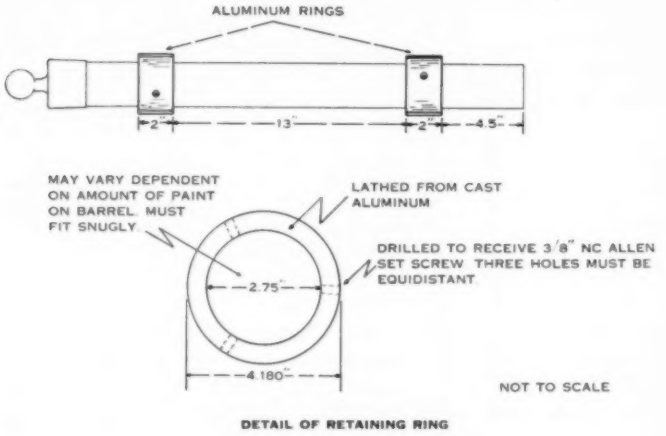


Figure 3. Detailed retainer ring drawings.

barrel and distributes the shock of recoil evenly over the end of the filler block. The center of the cap is threaded to receive the filler block retriever. The lower end of the block is drilled so that it will fit over the striker pin of the

4.2-inch barrel. This protects the striker pin when the recoil shock is exerted on the base of the 4.2-inch barrel. Detailed specifications of the filler block and shock cap are given in Figures 5 and 6.

The filler block retriever is used to remove the filler block from the 4.2-inch mortar at the conclusion of firing. Detailed specifications of this retriever are given in Figure 7.

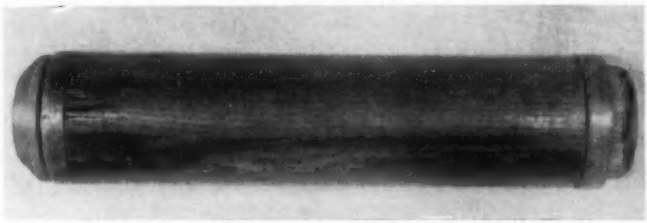


Figure 4. Filler block.

Assembling the subcaliber equipment for firing is a simple process. First, mount the 4.2-inch mortar. Then, slide the filler block down the barrel, *making sure that the shock cap end is up.* Finally, slide the insert (60-mm barrel with rings) down the barrel. When so assembled, the insert (60-mm barrel) protrudes approximately 1¼ inches out of the 4.2-inch barrel. (See Figure 8). Addition of the subcaliber assembly to the 4.2-inch mortar in no way affects the use of the 4.2-inch sight or the traversing or elevating mechanisms.

Disassembling the subcaliber equipment is equally as simple. Simply grasp the protruding muzzle of the 60-mm barrel and lift it out of the 4.2-inch barrel. Then, screw the retriever into the filler block and lift the block out.

When the M19 60-mm barrel is used as an insert the following additional modifications are required:

a. Shorten the filler block 3½ inches.

b. Set the 60-mm base firing mechanism on "drop fire."

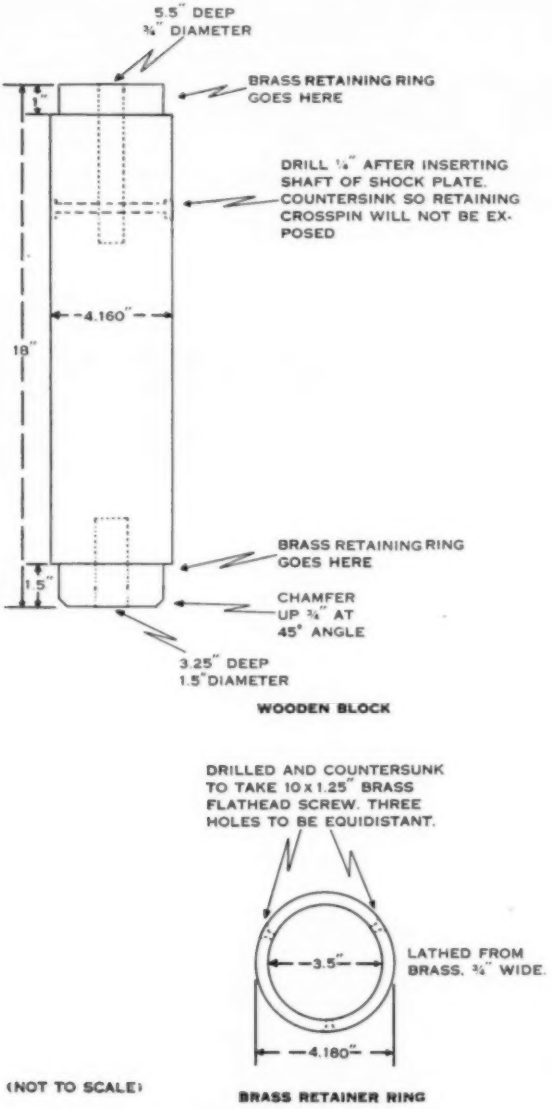

5.5" DEEP
¾" DIAMETER
BRASS RETAINING RING GOES HERE
DRILL ⅛" AFTER INSERTING SHAFT OF SHOCK PLATE. COUNTERSINK SO RETAINING CROSSPIN WILL NOT BE EXPOSED
4.160"
18"
BRASS RETAINING RING GOES HERE
1.5"
CHAMFER UP ¾" AT 45° ANGLE
3.25" DEEP
1.5" DIAMETER
WOODEN BLOCK
DRILLED AND COUNTERSUNK TO TAKE 10 x 1.25" BRASS FLATHEAD SCREW. THREE HOLES TO BE EQUIDISTANT.
3.5"
LATHED FROM BRASS. ¾" WIDE.
4.180"
(NOT TO SCALE)
BRASS RETAINER RING

Figure 5. Detailed filler block drawings.

c. Remove the 60-mm firing lever to prevent scoring of the rifling in the 4.2-inch mortar barrel.

Any type of 60-mm mortar ammunition, to include training shell, practice, and high explosive, may be fired from the subcaliber assembly. The most commonly used rounds are the 60-mm training shell and the 60-mm practice round. The former is fired on a training shell range, and the latter on a normal field firing range.

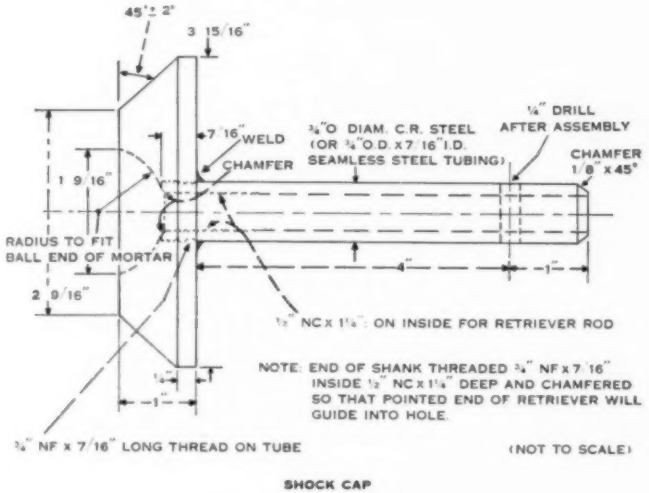

45°± 2°
3 15/16"
7/16" WELD
CHAMFER
¾"O DIAM. C.R. STEEL (OR ¾"O.D. x 7/16" I.D. SEAMLESS STEEL TUBING)
¼" DRILL AFTER ASSEMBLY
CHAMFER 1/8" x 45°
1 9/16"
RADIUS TO FIT BALL END OF MORTAR
2 9/16"
4"
1"
NC x 1¼" ON INSIDE FOR RETRIEVER ROD
NOTE: END OF SHANK THREADED ¾" NF x 7/16" INSIDE ½" NC x 1¼" DEEP AND CHAMFERED SO THAT POINTED END OF RETRIEVER WILL GUIDE INTO HOLE.
¾" NF x 7/16" LONG THREAD ON TUBE
(NOT TO SCALE)
SHOCK CAP

Figure 6. Detailed drawing of filler block shock cap.

A training shell range is simple to construct, requiring a minimum of space and effort. In selecting a site, consider these factors:

a. Effect of the training shell on the impact area. There is, of course, no burst on impact, but the effect of the 4½ pound cast iron round is quite detrimental to lawns or infields of ball diamonds.

b. Penetration of the training shell into the ground. The ground should be firm so that the round will not penetrate

too deeply for easy retrieving. In addition, the impact area should not be sodded so that the rounds' points of impact can be detected easily and the rounds quickly retrieved.

After selecting a site, divide the area into a target area, observation post (OP) area, and a mortar position area. (See Figure 9.) A range 100 feet in width is adequate for employment of one platoon.

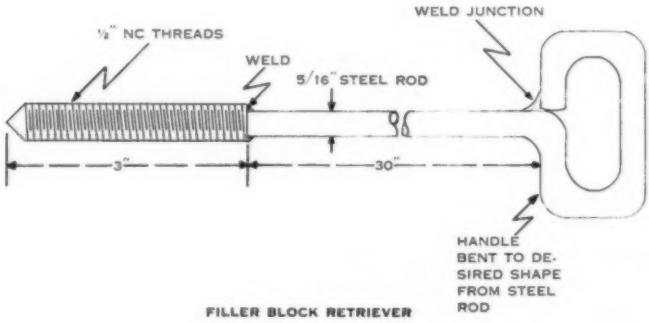


Figure 7. Detailed drawing of filler block retriever.

The target area consists of range markers and various targets staggered throughout the area. The range markers are placed at 100 foot intervals, the first marker being 400 feet from the OP position. The markers are rectangular with dimensions of approximately 12 inches by 18 inches. It is desirable to have targets constructed to represent objects, for example: trees, houses, etc. However, barrels and boxes placed throughout the area will do. Targets and markers may be constructed from scrap lumber and are more useful if they are portable. Having the targets and markers portable allows the target area to be cleared for other purposes when actual training is not being conducted.

The OP position area is located between the firing position and the target area. It should afford full observation of the target area. Normally, a four or five foot mound is sufficient for this purpose. To add realism establish tele-

phone communication between the OP and the fire direction center (FDC).

Locate the mortar position area about 50 feet to the rear of, and off line, from the OP position. Mortars are mounted approximately 15 feet apart laterally. A mask should exist between the target area and the mortar position. The OP

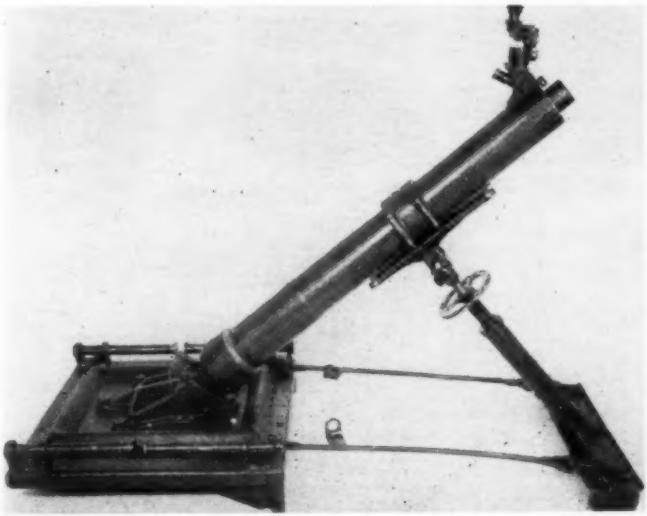


Figure 8. 4.2-inch mortar assembled with subcaliber device.

mound will suffice as a mask. If such a mound is not used, a target cloth screen may be placed between the mortar and target areas. The fire direction center is established near the mortar positions and uses voice communication with the mortars.

The round used on the training shell range is the 60-mm training shell, M69. The round is propelled by a single charge, the M4 ignition cartridge. When rounds are fired, they are retrieved, the spent ignition cartridges removed, new ones inserted, and the rounds are ready for refiring. If the fin assembly is broken during firing replace it with

a new one. When firing this round use the special firing table shown in Figure 10.

If a shortage of 4.2-inch ammunition prevents field firing, and 60-mm practice or high explosive ammunition is available, it may be used as a substitute in field firing training on field ranges. Before firing these rounds check FM 23-85 for characteristics and safety precautions that apply to

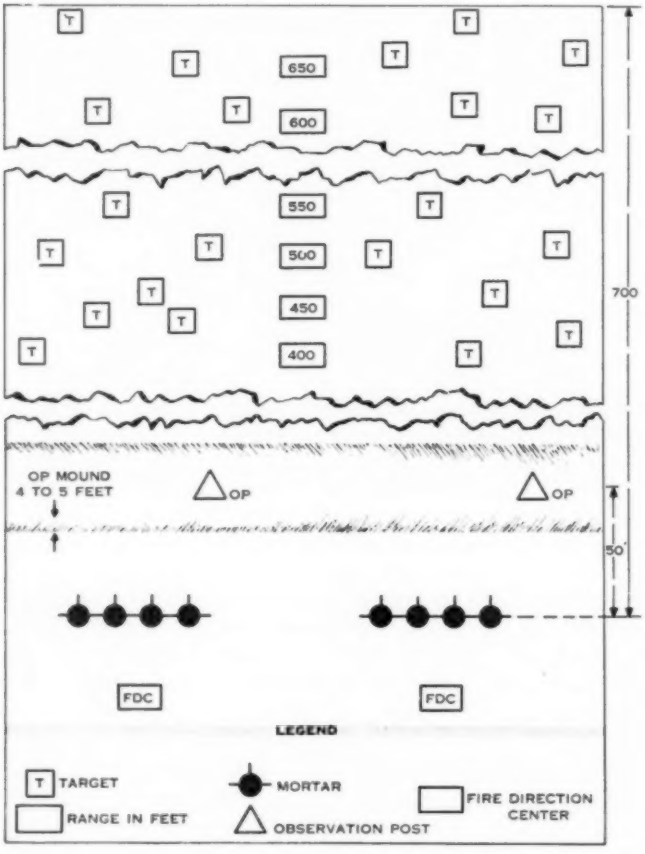


Figure 9. Training projectile range.

them. When firing these rounds use the special firing table shown in Figure 11.

When personnel being trained arrive at the range, assemble them at the OP for an orientation about the range organization. Assign individuals as crew members, FDC personnel, and forward observers. Rotate personnel periodically among these positions during training.

FIRING TABLE

FOR

MORTAR, 4.2-in, SUBCALIBER

FIRING

TRAINING SHELL, M69

RANGE FEET	ELEVATION MILS
450	1238
475	1210
500	1182
525	1156
550	1130
575	1100
600	1067
625	1030
650	990
675	920

NOTE: To obtain higher elevations, when limited by the elevation screw, place two sandbags, or similar objects, side by side under the standard base.

Figure 10. Firing table for use with the 60-mm training shell.

FIRING TABLE
for
MORTAR, 4.2-in, SUBCALIBER
FIRING
SHELL, H.E., M49A2, 60-MM
SHELL, PRACTICE, M50A2, 60-MM
with
FUZES PD M52, M52A1, M52A1B1

RANGE YD	ELEVATION MILS	CH	ELEVATION MILS	CH	RANGE YD	ELEVATION MILS	CH	ELEVATION MILS	CH
500	1240	1			1250	1128	3	1240	4
525	1220	1			1275	1114	3	1231	4
550	1194	1			1300	1100	3	1222	4
575	1170	1			1325	1084	3	1213	4
600	1143	1			1350	1068	3	1205	4
625	1120	1			1375	1051	3	1197	4
650	1092	1			1400	1035	3	1188	4
675	1060	1			1425	1015	3	1179	4
700	1023	1			1450	995	3	1170	4
725	987	1			1475	970	3	1159	4
750	933	1	1250	2	1500	950	3	1147	4
775	854	1	1235	2	1525	921	3	1136	4
800			1221	2	1550	895	3	1124	4
825			1205	2	1575	847	3	1113	4
850			1190	2	1600	800	3	1102	4
875			1176	2	1625			1091	4
900			1161	2	1650			1080	4
925			1144	2	1675			1066	4
950			1128	2	1700			1051	4
975			1109	2	1725			1030	4
1000	1248	3	1090	2	1750			1028	4
1025	1236	3	1057	2	1775			1011	4
1050	1222	3	1045	2	1800			995	4
1075	1211	3	1020	2	1825			977	4
1100	1200	3	995	2	1850			960	4
1125	1111	3	966	2	1875			935	4
1150	1178	3	937	2	1900			920	4
1175	1164	3	982	2	1925			898	4
1200	1150	3	827	2	1950			877	4
1225	1139	3			1975			820	4

NOTE: To obtain higher elevations, when limited by the elevation screw, place two (2) sand bags, or similar objects, side by side under the standard base.

Figure 11. Firing table for use with 60-mm practice or HE ammunition.

In general, training is conducted in the following sequence:

a. The OP sends a fire request to the FDC to begin a base point adjustment.

b. The FDC computes a fire command and sends it to the mortars.

c. Adjustment is continued until the base point registration is complete.

d. The FDC then directs the OP to adjust the sheaf of the platoon.

e. When the sheaf is adjusted the platoon is given a common referred deflection.

f. From this point on, various targets may be engaged employing the different types of adjustment.

When firing on the training shell range all corrections and computations are in feet; however, the mil formula (WORM) still applies. For best results, the FDC should allow each square on the M10 plotting board to equal 25 feet.

Certain safety precautions are necessary when firing the 4.2-inch mortar equipped with the subcaliber assembly. While these precautions may seem excessive, they are based on the assumption that, when 4.2-inch HE ammunition is used later in training, no special changes in procedure will be required. These precautions are:

a. Never allow personnel forward of the OP area while firing is in progress.

b. Never pound an ignition cartridge into the fin assembly since this may cause detonation of the primer.

c. Check the mortar for mask clearance.

d. Swab the bore prior to firing and swab it after each 10 rounds.

e. See that the tube cap is seated correctly in the tube cap cup.

f. See that the cup fork is inserted, locking the barrel in position.

g. See that the standard is locked to the coupling by the barrel pin.

h. See that the connector rods are attached to the hooks of the base plate.

i. Remove the sight before firing.

When a misfire occurs use this procedure for removal:

a. The gunner kicks the barrel. (This may dislodge a round which is stuck in the barrel.)

b. The gunner checks the insert barrel for heat. When the barrel is hot, the crew waits 10 minutes to allow the barrel to cool before removing the misfire. If barrel is cool wait one minute.

c. When removing the misfire, all personnel except the gunner and assistant move away from the mortar.

d. The assistant gunner gently removes the 60-mm barrel from the 4.2-inch barrel by grasping the 60-mm barrel around the muzzle with both hands and lifting. (See Figure 12.)

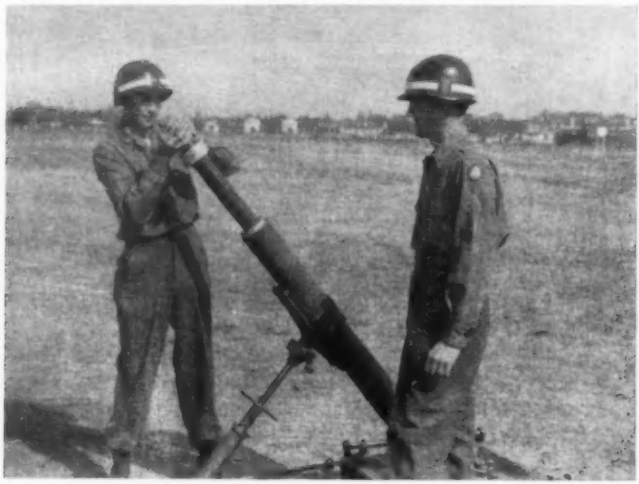


Figure 12. First step in removal of misfire.

e. The gunner grasps the base end of the 60-mm barrel as soon as it clears the 4.2-inch barrel. *He does not get behind it.*

f. The assistant gunner, hands still around the 60-mm barrel, extends the thumbs of both hands over the edges of

the muzzle. The gunner lifts the barrel until the round slides forward. *Once the barrel has reached the horizontal never lower it until the misfire has been removed.*

g. The assistant gunner stops the round with his thumb when it reaches the muzzle and removes it from the barrel. (See Figure 13.)

Figure 13. Second step in removal of misfire.

h. The assistant gunner hands the round to an ammunition handler. Do not touch the striker (HE or practice ammunition).

i. The gunner shakes the insert barrel to empty any extraneous material from the bore and reinserts it into the 4.2-inch mortar.

j. The assistant gunner swabs the bore.

Simple to construct, the 4.2-inch subcaliber device described in this article is invaluable for training heavy mortarmen. Forward observation principles, fire direction procedure, and crew-drill can be taught as effectively as when regular 4.2-inch ammunition is used. All it takes, besides the subcaliber device itself, is a little ingenuity and intelligent application of training principles.

"Take a Patrol . . . "

Capt Robert G. Kimball, Infantry

Lieutenant Swords looked about his wooded hilltop with satisfaction. He couldn't see much but the trees and bushes of the woods. That was good, for scattered among those trees and bushes were the men of his platoon, all dug-in, with holes covered and camouflaged.

"Pretty good job," he thought. "Darned good job."

His unit, the 1st Platoon of Company A, along with the rest of the company, had been relieved from the main line of resistance during the night, and now formed part of the battalion reserve. In the dark, the company had moved back into position, and now, with the coming of daylight, everything, as far as the 1st Platoon was concerned, was all set. They could relax a bit.

Lieutenant Swords walked to his CP—his hole with other holes adjacent to it in which his messenger and the platoon sergeant slumped wearily.

"Better call the Old Man and tell him we're all set up," he thought.

Before he could pick it up a faint whistle shrilled from the sound-power telephone. The messenger answered it, "Red-one-one, messenger speaking."

A pause. "Yes, sir." He handed the phone to Swords. "For you, sir."

"One-one speaking," the lieutenant said into the mouthpiece.

The Old Man's voice came tinnily from the instrument. "How are you coming, Swords? About set-up?"

"Yes, sir." Men dug-in and holes covered." Then with a note of conscious virtue in his voice, "And holes all camouflaged already, sir."

"Good, good," his commander complimented him. "But don't settle down for a rest just yet. Battalion just called. You're to report there at 0800 to be briefed on a patrol."

Lieutenant Swords made a wry face. There went his rest. Battalion policy was to have the reserve company do all the patrolling. The sleepless night just ended would be followed by another one—sleepless, and a devil of a lot more difficult.

"Sir, is this to be a combat or reconnaissance patrol?"

"Don't know, Swords, but you'll find out when you get to battalion. Better start out; it's 0715."

"Yes, sir."

The platoon leader put the phone down and called over to his second-in-command. "Come over here, Sergeant."

The platoon sergeant crawled out of his hole. "No rest for the wicked, Lieutenant?" he asked.

"Patrol," Swords answered briefly. "Have to report to battalion. You take over. Let 'em rest as much as you can, but see that each squad has some one alert. Probably be back in an hour or so."

"Yes, sir. Patrol members coming out of this platoon, sir?"

"I don't know. Tell you when I get back," and Lieutenant Swords stalked away to the rear. Once back of the hill, he unfolded his map of the area and began reviewing the situation.

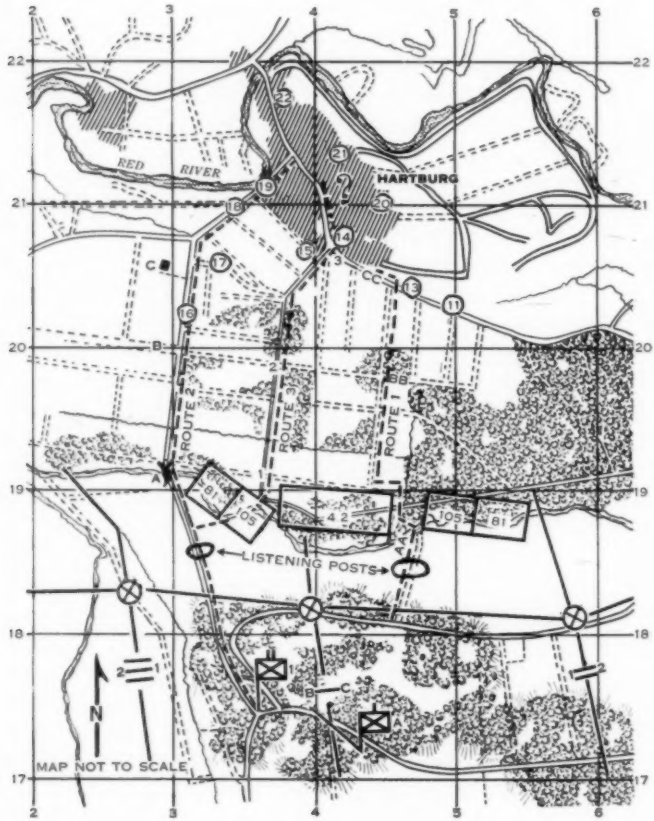
Now, you, the reader, take over. From this point on you are Lieutenant Swords. His problem is now your problem. To solve it you'll need the map accompanying the problem and a knowledge of the subject. There are six requirements. Solutions are given to each requirement, plus a discussion of each solution. To get the most benefit from this problem, it is recommended that you solve each requirement as you come to it before you refer to the solution that follows.

THE PROBLEM

1. *General situation.*

a. The 1st Infantry has been holding defensive positions facing generally north and along the high ground several

thousand yards south of the Red River for the past week. Limiting points, adjacent units, boundaries, and command posts are shown on the map. All artillery and mortar barrages are shown. (Note: Map not drawn to scale.)



The 1st Infantry has stopped on hills short of the Red River because the terrain between its positions and the river is low and can be flooded by opening the dams, which are in enemy hands, a few miles up the river.

b. Aggressor is believed to be defending the far bank of the river in strength and perhaps outposting the near bank at night. Numerous Aggressor patrols have tried to infiltrate front line positions. These patrols continue active even though some have been annihilated.

c. Your platoon, as well as the rest of the battalion, has suffered very few casualties and morale is high.

2. *Initial situation.*

a. Arriving at the CP you are told to report to the battalion commander, himself. He receives you with that particular degree of deference reserved for those about to perform a difficult and dangerous mission.

"Sit down, Lieutenant. Look at your map." He proceeds to orient you on the battalion positions and then mentions that enemy patrols have been active this side of the Red River.

"Now," he says, "We think those Aggressor patrols are crossing at the town of Hartburg (0421) to operate on our side of the river. If so, we believe they cross during darkness, come out of Hartburg, infiltrate our positions, then withdraw north of the river before daylight.

"Lieutenant, I want you to take a patrol down to the river in Hartburg, tonight. Your mission will be to bring back prisoners for questioning.

"Decide for yourself how many men you'll take with you. You'll be supplied with any special equipment or weapons you need.

"We'll notify our own and adjacent front line units of your patrol, and have them inform their outposts.

"You'll have fire support on call from our 81-mm mortars, heavy mortar company, and 1st Field Artillery Battalion.

"Your time of departure will be your decision but notify S-3 so he may notify our own and adjacent front line units.

"Keep in contact with battalion by SCR-300 radio. No set time on reporting. Check with my communication officer for call signs.

"There'll be no other patrols operating from regiment, tonight, so consider anyone contacted forward of our outposts as hostile.

"Check with my S-2 for the challenge and password.

"Darkness at 1845; daylight 0625. It is now 0845. Any questions?"

You shake your head. "No, sir."

"Good luck, Lieutenant."

You've been tossed the ball. What happens from here on out is up to you. To get the most from this problem, read each requirement as you come to it, solve it, *then* consult the solution and discussion following the requirement.

3. *First requirement*: After learning your mission, what are your actions prior to leaving the battalion command post?

4. *Solution to first requirement.*

a. Study your map so you may begin your planning.

b. Make a tentative plan.

c. Coordinate with the necessary personnel that may be present.

5. *Discussion of solution to first requirement.*

a. The first step in your planning is to get an idea of the terrain over which you must move. The quickest way to do this is to study your map. Do this before leaving the battalion command post since questions may arise which can be answered easily by members of the staff. As you study the map, determine ground distances accurately. Note also, the location of all friendly outposts and other troops, but do not plot these on the map if you intend taking it with you. Finally, study the enemy situation on your map and determine the best method of accomplishing your mission.

b. After studying your map you are ready to outline mentally your plan of action—make a tentative plan. You make this plan before leaving the command post, so you can carry out any coordination necessary while you're still at the CP. It is now that you decide how many men you will need; and how much fire support, if any. Make these decisions after you estimate the enemy situation.

You decide what equipment you'll need—remembering you travel only with essentials since too much equipment will hamper the movements of your patrol. You decide also what weapons you'll need—extra automatic weapons, grenades, or even weapons for silent killing.

c. After you make your tentative plan you coordinate with the necessary personnel. If you decide to call for supporting fires of the heavy weapons company, it is now that you coordinate with the company commander or his representative. For possible artillery support, see the artillery liaison officer who will be present at the battalion command post. Check with your battalion supply officer for the special equipment or automatic weapons needed, and for the necessary supply of ammunition for these weapons. You check with the battalion communication officer for your SCR-300 radio. Arrange to have them delivered to a selected location where you can pick them up. Check with the communication officer for call signs to be used.

Now, coordinate with S-2, the intelligence officer, for the latest enemy information and challenge password, and S-3, the operations officer, to see that all adjacent units as well as outposts have been notified of your patrol and time of departure.

6. *Situation continued.* It is now 1100 hours and you've returned to Company A's command post. Before leaving the battalion CP you made your map study and a brief estimate of the enemy situation. You decided to take nine men, making a full squad, and a medical aid man on the patrol. This will give you enough men to accomplish your mission, and they will be easier to control acting as a squad. You asked the supply officer for four extra BAR's for the squad and four grenades for each man. These are to be at Company A's command post at 1600 hours. You verified that adjacent units and outposts were notified of your patrol. You found out what radio channel you'll use. You arrange to have artillery, 81-mm and heavy mortar concentrations plotted along your route and within the town. These are to be on call by prearranged numbers.

7. *Second requirement.* What are your actions from the

time you return to the company command post until you are ready to issue your order to your patrol?

8. *Solution to second requirement.*

a. You notify your company commander of your mission and briefly tell him your plan.

b. Select the members of your patrol.

c. Issue a warning order to the members, telling them *who* will go, *what* they'll do, *where* they'll go, *when* the patrol starts, and *why* it's to be made.

d. Make as thorough a ground reconnaissance as circumstances will permit.

e. Completing your reconnaissance, you make your final plan for carrying out your mission.

9. *Discussion of solution to second requirement.*

a. You tell your company commander of your mission and your tentative plan since he is interested in the actions of all members of his command. Also, there are many ways in which he can help you. He can assist in supervising the preparations made by members of your patrol, and while you're on patrol he'll be able to help get the fire support you may need, since his radio will be on the same channel as yours.

b. In choosing your patrol, select men who are capable and in the best physical condition. Don't choose any man with a cold or cough; his sneezing or coughing would endanger the entire patrol. Take an aid man along. He may be needed if you have a fire fight.

Select a noncommissioned officer as second-in-command. Get the best qualified man you can lay hands on because he'll take over the patrol if you become a casualty. He helps prepare your final plans and helps other members to get ready for the patrol.

If any specially trained personnel had been required to go with you, such as engineers or interrogators, they would have been selected by higher commanders in which case you would check to see who these people would be.

c. After selecting all patrol members and notifying them, issue your warning order including a brief statement covering the activities of your unit and the enemy, the mission of your patrol, explicit directions on uniform, camouflage, if any, removal of identifications, and checking of weapons. Finally you set the time and place for issuing your patrol order.

d. Accompanied by your second-in-command, you move out to make your ground reconnaissance. You select as many points as possible in the battalion zone from which to observe as much of the terrain as possible.

You study the terrain from both your own and the enemy's viewpoint. You ask yourself: "How will the terrain influence my own action? Since enemy patrols are active what routes can they use? What are their most likely routes? Where could the enemy plan ambushes? Where does he have good fields of fire?" All of these questions go through your mind as you make your reconnaissance and as you consider all possible appproaches to your objective. Since you are leading a night patrol, you memorize all terrain features that will affect accomplishment of your mission.

e. You have completed your reconnaissance and are ready to make your final plans. You consider all plans open to you for the accomplishment of your mission. If time permits, you use a small sand table to set up the terrain over which you must patrol. You use it to check your plans and also as an aid in instructing your patrol. You frame your final plan in detail: route to be used, alternate routes if any, formation, time of departure, security measures, rallying points, and even care of your wounded. (On the way out, seriously wounded are treated and left with a guard to be picked up on your return, while slightly wounded continue with you. You do not want wounded men to return to friendly lines alone.) You leave out no details no matter how minute they seem.

10. *Situation, continued.* You have finished your reconnaissance both in Company B's and Company C's zones and you and your second-in-command have moved back to

Company A's area where a small sand table has been set up hurriedly. You have made the following notes to aid you in issuing your order:

a. General situation.
(1) Information of enemy.
(2) Information of own troops.

b. Mission of patrol.

c. Plan of action.
(1) Time of departure and return.
(2) Route to be followed.
(3) Chain of command.
(4) Initial formation.
(5) Specific duties of each member.
(6) Action upon enemy contact.
(7) Initial rallying point.
(8) Action at rallying point.
(9) Action at objective.
(10) To whom and when to report patrol results.

d. Administrative matters.
(1) Arms and ammunition.
(2) Equipment for each member.
(3) Method of handling wounded.
(4) Method of handling prisoners.

e. Command signal matters.
(1) Signals to be used for control of patrol.
(2) Challenge and password.
(3) Radio call sign and any codes to be used.
(4) Your location in the formation.

11. *Third requirement.*

a. What time do you decide to depart on your patrol? Why?

b. Of three possible routes, 1, 2, and 3, (see map), which route do you select? Why?

c. What is your initial formation?

d. What locations do you select for your rallying points?

e. What signals will you use for control?

f. What will be your location in the formation?

12. *Solution to third requirement.*

a. You decide to depart at 1900 hours.

b. You choose to go by Route 2 which leads from Company A's zone.

c. You decide to go in a column formation—on the right side of your route.

d. The outpost at (032186), the bridge at Point A (029191), and the crossroads at Point B (032200) are selected as your rallying points. You may select others as you move along your route.

e. Control will be maintained by whispering your orders to the man nearest you who in turn will whisper to the man nearest him and so on down the line. You also will use touch signals and each man will base his movements on the actions of the man in front of him.

f. You will be near the point in the column. Your second-in-command will be the last man in the column.

13. *Discussion of solution to third requirement.*

a. 1900 hours was selected as your time of departure since darkness is at 1845 hours. Your time of return cannot be determined at this time. This allows you 15 minutes after darkness to assemble your patrol and gives you the assurance of complete darkness when you start. Darkness is your friend and ally. The fact that you are to bring back prisoners also influenced your choice of this time. An early departure betters your chances of contacting enemy patrols early in the evening since Aggressor will have had time to dispatch his patrols in case he intends operating in the area. The battalion commander may or may not assign you a route. In this case he left the decision to you.

b. You based your decision to use Route 2 on the fact that it followed a road, the most prominent and most easily identified terrain feature in the area. This helps simplify control. Also since this is the easiest route, the enemy may use it, too, improving your chances of contacting and capturing prisoners. One more consideration is the fact that you want to enter the town from the flank, since approaching an objective from the front is avoided whenever possible.

Route 2 is ideal from that stand point, approaching as it does from the enemy's right flank.

Route 1 would have given better concealment and cover since it is wooded, but movement would be slower and noisier and ambush more likely to occur in a wooded area than in the open.

On Route 1 the many similar intersecting trails would increase your chances of losing direction and control. Although Route 2 is open, in case of contact the ditches on each side of the road will afford some cover; and in case of dispersion or loss of control, members of your patrol will be better able to identify this route for their return to the last designated rallying point.

Route 3 also has concealment and some cover since it, too, is wooded, but again movement would be slower and noisier and ambush more likely to occur.

You become familiar with Routes 1 and 3 and point them out to your patrol members so that in case of necessity one of them can be used as a return or alternate route.

c. Many factors enter into your decision to use the column formation. First, you consider your mission. Since your knowledge of the enemy is limited and a fire fight probable, you feel that you'll need the flexibility of the column formation. Since you'll be traveling through slightly wooded terrain in darkness, you'll need the ease of control resulting from a column formation. Speed is essential on any combat patrol; so again this formation is best, since men will be able to follow one another more rapidly. Even though it should be subjected to frontal fire, a column formation permits dispersion while control is still retained. Considering secrecy, your men will move more quietly since you will have no flanks moving through the underbrush. Finally you consider the size of your patrol. With a patrol of this size, a column formation is almost mandatory for control.

d. Since a rallying point is a place where your patrol will reassemble if separated or dispersed, it should be near a prominent terrain feature and easily recognized. It should afford cover and concealment and favor your defending it. Some times your patrol route will be long enough to warrant

more rallying points but you consider that an initial one and two others are enough in this case. If you find the distance does get too great then you may select additional points as you move along. You indicate these points to each man individually as you reach them.

If the enemy surprises your patrol and it becomes dispersed, the members return to the rallying point where, once reassembled, you continue your mission, using an alternate plan.

Point A was selected as a rallying point since the initial one should be near, or even within your own front lines in order to assure adequate defensive support.

The bridge at Point A (029191), an easily recognizable terrain feature along your route, is selected as your second rallying point. It is located over a wooded ravine that affords cover and concealment and favors a defensive stand.

The crossroads at Point B (032200) is selected as your third rallying point as it is approximately half the distance between your last point and the town. Also, it is easily recognized.

e. Controlling a night patrol is difficult. Patrols up to squad size may be controlled by direct contact between the leader and each member. On a patrol larger than a squad, each man should be capable of passing your orders to the man next to him. Since you will be moving near the point, a system of signaling by touch and relaying whispered orders is logical for this size patrol. Periodic pauses to check your patrol will help keep closer control.

f. Being near the point in the column you will be where you can best control your patrol in case this contact is made. Your second-in-command is placed at the last position in the column. He will be in the best position to assist you in controlling your patrol.

14. *Situation continued.* Each member of your patrol has been thoroughly briefed and your order has been issued. All questions have been cleared up. The members of the patrol continue preparation under your supervision. The patrol has been inspected and discrepancies corrected.

Equipment has been checked. Your radio has been calibrated and a final check made with battalion radio.

You have made a final check with battalion to verify that all adjacent units and your own front lines and outposts have been notified of your route and time of departure.

It is now 1915 and you have just checked through the outpost in Company B's area.

Upon reaching the bridge at Point A you personally move to each man, after halting the patrol, and point out that this is a rallying point to be used in case of dispersion or loss of control.

A very quick reconnaissance verifies that the stream is fordable.

You report to battalion that the bridge has been reached, the condition of the bridge, and the fact that the stream is fordable by vehicles.

Your patrol is moving along the route very aggressively when the point halts and motions you forward. Moving up quickly you find that an antitank mine field has been encountered across your route at Point B (032200).

15. *Fourth requirement.* What are your actions and orders at this time?

16. *Solution to fourth requirement.*

a. You designate two men to reconnoiter to the right and two men to the left to determine the extent of the mine field.

b. Keeping the patrol halted you place its members for all-around security.

17. *Discussion of solution to fourth requirement.*

a. You reconnoiter the flanks of the obstacle to see if it can be by-passed and if it is covered by fire. If possible the mine field will be by-passed since it may contain antipersonnel as well as antitank mines. Barbed wire in front of the mines may be a further obstacle supplementing the mine field. If you must go through a barbed-wire protected mine field, you cut your own gap. Gaps left by the enemy probably are well-protected.

If it is impracticable to by-pass the field, you take one man forward with you to investigate the obstacle more thoroughly. After a gap has been made, you send your security through, then move the remainder of your patrol through.

b. Placing your men to give all-around security is habitual at a halt. You are always alert for an ambush.

18. *Situation continued.* Your men, sent out to reconnoiter the flanks, return and report that the mine field extends about 50 yards on either side of the road. They also report it is a hasty mine field and none of the mines seem to be buried. The reconnaissance team that reconnoitered to the right reports finding a large pile of mines and some tools.

You immediately sense that work will probably be resumed by the enemy to extend the present field or change it from hasty to deliberate.

You again radio battalion telling them of the mine field and its location.

With your patrol you move out, still in column formation, and by-pass the mine field on the right side of the road. Your second-in-command is still bringing up the rear of the column.

After moving 300 yards you see at Point C a high building on the left of the road (029206). At the same time you see five Aggressor soldiers approaching the building. They are coming from the outskirts of the town.

19. *Fifth requirement.* What are your actions and orders at this time?

20. *Solution to fifth requirement.* Halt your patrol. Order your second-in-command to take half the men, cross the road, and move to the northeast side of the house as a security force. You take the remaining men in toward the near side of the house, as an assault group.

21. *Discussion of solution to fifth requirement.* You keep your mission in mind—to capture prisoners. Here's a chance to take prisoners. You make an assumption that they are not in position and should be particularly vulnerable. By closing in on the building with your assault group, you feel that you will catch them by surprise and your security group will cut off the enemy's most likely route of withdrawal.

22. *Situation continued.* Just when you and your group have crossed the road and are near the house and start closing in, an enemy automatic weapon opens fire from the top floor of the house. You order your assault group to rush the house and fire all weapons. Your security group remains in position prepared to support your assault, to cut off the retreat of the enemy group, or to provide your security as required.

As your men start entering the building enemy automatic fire is received from two or three places across the river.

You radio battalion and call for all prearranged fires on the town in order to protect you and prohibit the enemy from reinforcing their group. The fires fall and in the meantime your men are moving from room-to-room. A quick check reveals that only one of the enemy has been killed. Taking the remaining four as prisoners, your patrol assembles on the road.

23. *Sixth requirement.* What are your next actions?

24. *Solution to sixth requirement.* You withdraw your patrol.

25. *Discussion of solution to sixth requirement.* The enemy knows you are in the area as was evidenced by the fire received from across the river. To try and enter the town now would probably mean a continuous fight all the way through. The artillery is continuing to fall, thus covering your withdrawal. Have you accomplished your mission? Yes, your mission was to capture prisoners. Since you have

captured four prisoners the correct decision is to make an orderly withdrawal covered by prearranged fires.

26. *Situation continued.* You account for each man, determine there are no casualties, then move your patrol back toward the friendly lines, keeping a continuous guard for a possible ambush both from the flanks and rear. You and one man approach the outpost in Company B with caution until you are able to identify your patrol to the outpost. The remainder of your patrol is accounted for as it passes the outpost. It is checked here for any possible enemy infiltrators that may have mingled with your patrol.

You turn the patrol over to a noncommissioned officer and send it back to the company CP while you, with your second-in-command, two guards, and the prisoners, go to the battalion CP.

You turn your prisoners over to S-2 for questioning and make your report to the battalion commander. After the report, feeling rather proud of the actions of your men and the success of the patrol, you return to your command post for some much needed rest.

Once again you've proved that *planning is the most important part of any successful patrol.*

Capabilities of the Airborne Division **by Major Lyman S. Faulkner. The author tells the capabilities of the new airborne division. To appear in the October QUARTERLY.**

Covering the Withdrawal Into Bataan

Lt Col Bruce Palmer, Jr., Infantry

The author compiled this article from source material available at The Infantry School. No other records were consulted. There is a possibility of slight discrepancies in regard to facts and dates, although every effort has been made toward complete accuracy. EDITOR.

INTRODUCTION

American troops participated in large scale, sustained movements to the rear in only a few instances during World War II. One such instance was the delaying action by which the North Luzon Force (NLF) covered the withdrawal of our troops into Bataan in December 1941 and January 1942. It is only too easy to avoid the subject of retrograde movements as they imply adverse circumstances, or even defeat or disaster. Because of this, we may be neglecting the subject. Thus a study of this operation should be profitable.

NARRATIVE OF THE ACTION

Early on the morning of 8 December (7 December in the U. S.) 1941, the Commanding General, NLF, received the news from the G-3, U. S. Army Forces in the Far East (USAFFE) in Manila that the Japs had bombed Pearl Harbor. In the Philippines the first enemy blow also came from the air as the Japs struck Clark Field at about 1230, 8 December and wrecked our heavy bomber force based there. At about the same time, enemy air strikes hit Nichols Field (near Manila), Iba Field, and Del Carmen Field, and destroyed the bulk of our fighters on Luzon. These actions were to have a profound influence on the ensuing course of events. During the next several days, what was left of our patched-up bombers departed Clark Field for

safer bases to the south. Thereafter, the entire campaign took place under conditions of complete enemy domination of the air, as well as of the sea.

The NLF was responsible for the defense of northern Luzon, generally that part of the island lying to the north of Manila. In planning the defense of Luzon, it was anticipated that the major enemy landings would be made in the Lingayen Gulf area with the main enemy effort directed down the Central Plains in the direction of Manila. Initial troop dispositions for the defense of northern Luzon are shown on Map No. 1.

The troops to be available to the CG, NLF, numbered about 28,000 officers and men, most of whom were raw Filipino recruits in reserve Philippine Army (PA) units which had been inducted into the Army of the United States only a few months before hostilities started. Major troop units of the NLF were the 11th Division (PA), the 21st Division (PA), the 71st Division (-1 Regt) (PA), the 91st Division (-1 Regt) (PA), and the 26th Cavalry Regiment (Philippine Scouts) (PS). The Philippine Army Divisions of the NLF were understrength, untrained, only partially organized, and were far from being equipped. Infantry units had little more than Enfield rifles and a few rounds of ammunition, while field artillery units were equipped with a few obsolete British 75-mm and 2.95-inch mountain guns for which there was little ammunition. The only unit which the NLF could really depend on was the 26th Cavalry (PS), a well-trained Regular Army unit. This regiment, however, was only 800 strong, and although it had all its authorized equipment, including M-1 rifles, it lacked such essential items as mortars and antitank weapons. In fact the only available weapon which could be termed an antitank gun was the .50 caliber machine gun. Further, the regiment was destined to fight the entire action without artillery support.

The NLF had virtually no military transportation and no communication equipment. Some transportation was provided by requisitioning commercial buses and private civilian vehicles. For electrical means of communication

(-1 BN) (FROM 48TH JAP DIV ARMORED)
(10 DEC 1941)
APARRI
LAOAG
(-)
(FROM JAP REGT LANDING AT APARRI)
(10 DEC 1941)
VIGAN
CAGAYEN
TUGUEGARAO
RIVER
(-)
BONTOC
26(PS)
12(PA)
13(PA)
SAN FERNANDO (LA UNION)
BAUANG
BAGUIO
AGNO RIVER
LINGAYEN GULF
AGOO
DAMORTIS
ROSARIO
BALETE PASS
SAN FABIAN
SUAL
LINGAYEN
DAGUPAN
11(PA)
21(PA)
71(PA)
ROSALES
71(PA) (USAFFE RESERVE)
PAMPANGA RIVER
BALER BAY
26(PS)
TARLAC
NLF
CABANATUAN
91(PA) (USAFFE RESERVE)
DINGALEN BAY
IBA FIELD
31(PA) (USAFFE RESERVE)
CLARK FIELD
FT. STOTSENBURG
1PROV
DEL CARMEN FIELD
26(PS)
SAN FERNANDO (PAMPANGA)
PHIL (USAFFE RESERVE)
XXXX
USAFFE
INFANTA
NLF
SLF
SUBIC BAY
BATAAN
MANILA BAY
MANILA
NICHOLS FIELD
LAMON BAY
LAGUNA DE BAY
CORREGIDOR
41(PA)
1(PA)
LAKE TAAL
51(PA)
INITIAL TROOP DISPOSITIONS OF THE NORTHERN LUZON FORCE 10 DEC 1941
0 10 20 30 40 50 60
MILES

Map 1.

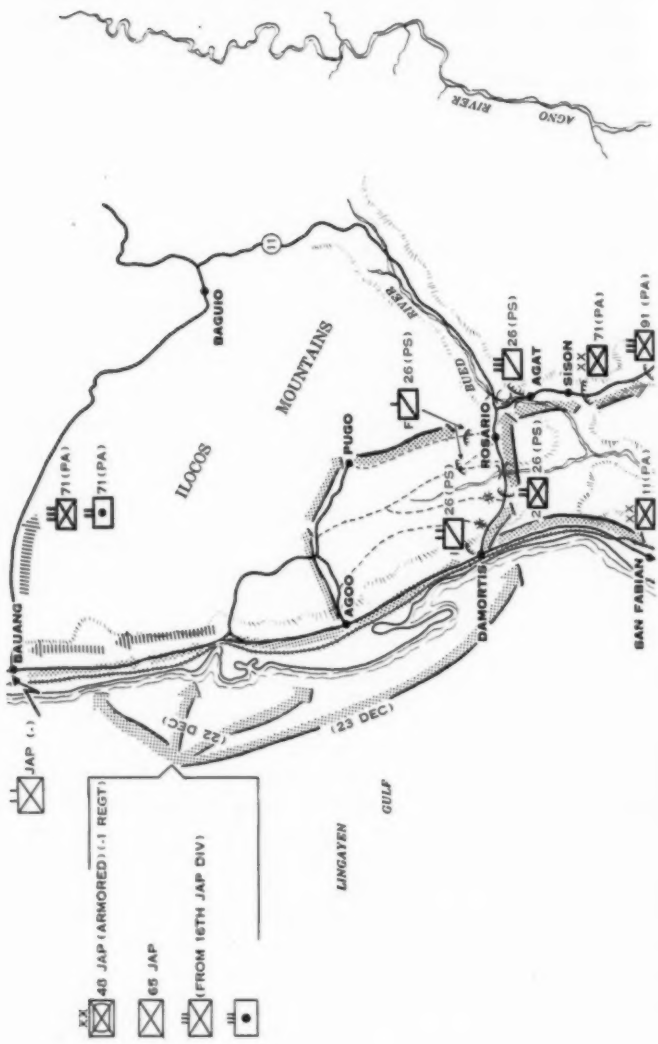
with its major units, the NLF had to depend on the public telephone and telegraph system.

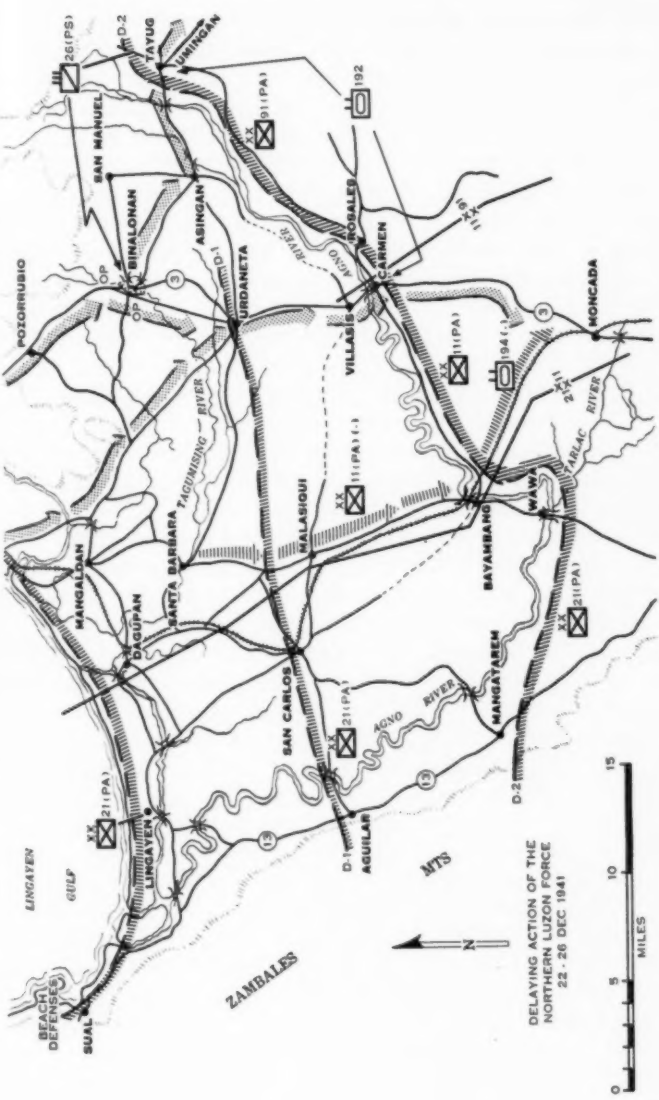
The Japs made no amphibious moves until 10 December, when they landed a regiment (-1 Battalion) at Aparri on the northern tip of Luzon, and the other battalion of this regiment at Vigan on the northwest coast. These moves were correctly interpreted as feints, and no major units were committed to the north, but instead the enemy routes of advance to the south were blocked with relatively small forces. The entrance into the Central Plains on the east was blocked at Balete Pass with a battalion of the 71st Division (PA). On the west, an east-west line across the narrow coastal plain in the vicinity of San Fernando (La Union) was established with two battalions of the 11th Division (PA).

After securing his objective airfields in northern Luzon (see Map No. 1), the enemy moved south, striking hard at the San Fernando position on 21 December. The green Philippine Army troops were completely scattered, remnants taking to the mountains. The CG, NLF, immediately ordered a counterattack employing part of the 71st Division (PA), just released from USAFFE Reserve to NLF control, and the 26th Cavalry (PS).

The 71st Infantry Regiment (PA) with one field artillery battalion, from the 71st Division (PA), on 21 December was rushed by motor up the coastal road with the mission of striking the advancing Jap column north of Bauang. Meanwhile, the 26th Cavalry (PS), had marched north, reaching Rosario early on 22 December, where it was attached to the 71st Division (PA), the remainder of which was being brought forward to reinforce the weakened coastal defenses. Here the 26th Cavalry (PS) received word from its scout cars operating near Damortis that the enemy was landing in force on the beaches to the north and meeting only slight opposition from the scattered Philippine Army troops in the vicinity. (See Map 2.)

The Japanese scheme of maneuver was now manifest. The enemy drive down the east coast of the gulf was only a part of a well-coordinated plan, as the main landings


AGNO RIVER
BAGUIO
MOUNTAINS
ILOCOS
RIVER
BUED
26 (PS)
ROSARIO
AGAT
SISON
71 (PA)
91 (PA)
FUGO
AGOO
DAMORTIS
SAN FABIAN
11 (PA)
BAUANG
71 (PA)
JAP (-)
(22 DEC)
(23 DEC)
LINGAYEN
GULF
48 JAP (ARMORED) (-1 REGT)
65 JAP
(FROM 16TH JAP DIV)


LINGAYEN GULF
BEACH DEFENSES
SUAL
LINGAYEN
21 (PA)
ZAMBALES
MTS
AGUILAR
D-1
SAN CARLOS
21 (PA)
AGNO RIVER
MANGATAREM
D-2
MANGALDAN
DAGUPAN
SANTA BARBARA
TAGUMING — RIVER
MALASIQUI
11 (PA) (-)
BAYAMBANG
WAW
TARLAC RIVER
211 (PA)
PANTABANGAN
194 (-)
MONCADA
CARMEN
ROSALES
VILLASIS
AGNO RIVER
URDANETA
D-1
ASINGAN
BINALONAN
OP
SAN MANUEL
TAYUG
D-2
UMINGAN
26 (PS)
91 (PA)
192
POZORRUBIO
DELAYING ACTION OF THE NORTHERN LUZON FORCE 22 - 26 DEC 1941
N
0 5 10 15
MILES

Map 2.

took place south of Bauang very early on 22 December. At several beaches extending from Bauang almost to Damortis, the enemy landed a reinforced armored division, completely motorized and with unusually heavy artillery support. Since our main beach defenses had been prepared at the head of Lingayen Gulf along the line Sual-Dagupan-Damortis, the enemy's main force met only slight opposition and was now in position to concentrate on the eastern flank of our coastal positions. At any rate, the bulk of the 71st Infantry Regiment (PA) and its supporting field artillery battalion were cut off by these new landings and retreated into the mountains on the road from Bauang to Baguio.

With the failure of the counterattack up the coast, the CG, NLF, decided to fight a delaying action on his right flank. The mission given to the 26th Cavalry (PS) at this time was a difficult one—to hold the enemy north of the Damortis-Rosario Road (Highway 3) and if forced to withdraw, to execute maximum delay along that axis. The road from Damortis to Rosario, running through the foothills of the mountains of northern Luzon rising to the north, is extremely winding and offers only a few positions with good fields of fire at medium and long ranges which would be suitable for delaying action. Several trails lead from the Agoo area through the mountains to the Damortis-Rosario Road, affording the enemy excellent opportunity for flanking movements. The regimental commander decided to employ his 1st Squadron on the first delaying position, selected on the high ground just to the north and east of Damortis, to block the major trails leading northward from the road with Troop F of the 2d Squadron, and to have the rest of that squadron organize a second delaying position astride the road and about 6,000 yards east of Damortis. This left in reserve the machine gun troop (-) and the regimental headquarters, which were held mobile just in rear of the initial position. (See Map 2.) (Note: The 26th Cavalry (PS) consisted of Headquarters and Service Troop, which included a scout car platoon, a machine gun troop (.30 caliber and .50 caliber machine

guns), and two squadrons each consisting of a squadron headquarters detachment and three rifle troops. Each squadron at this time had one rifle troop detached on a separate mission which left only two rifle troops per squadron. Each rifle troop was organized with three rifle platoons and a light machine gun platoon.)

The 1st Squadron, 26th Cavalry (PS) moved forward during the morning of 22 December and organized the first delaying position while under heavy dive-bombing attack which caused severe losses. Occupation of the position was covered by the scout car platoon which outposted a line about 1,000 yards to the north of Damortis and was already hotly engaged with leading enemy elements. By 1300 the enemy had launched a coordinated infantry-tank attack heavily supported by artillery, naval gunfire, and dive-bombers. Despite the fact that its left flank was overrun, the 1st Squadron troopers managed to extricate themselves under the cover of the regimental reserve delaying from an intermediate position. The withdrawal was effected under severe dive-bombing attack and was closely followed by enemy tanks.

By 1700, 22 December, the regiment had closed on the second delaying position, which under original plans was to have been held all the night of 22/23 December and as long as possible the next day. With this in mind, a platoon of light tanks had been sent forward with the mission of covering the second delaying position until 2000, at which time the tanks were to withdraw through the 26th Cavalry (PS) to an assembly area near Rosario. This tank platoon, from the 192d Tank Battalion (light tanks), was operating independently and was not attached to the 26th Cavalry (PS). In fact the 192d Tank Battalion, although it was in the Lingayen Gulf area, was not even under the control of the CG, NLF, but was part of the 1st Provisional Tank Group operating directly under USAFFE.

Just at dusk on 22 December, the orders of the 26th Cavalry (PS) were changed by the CG, 71st Division (PA). The regiment was to withdraw at dark from the second delaying position to the Bued River crossing near the bar-

rio of Agat, where it would take up a position to cover the 71st Division (PA), which was to establish a defensive line to the south near Sison astride Highway 3. The tank platoon to the front of the regiment was to follow the column to prevent surprise armored attacks while enroute. However, as the regiment pulled out of its positions shortly after dusk and assembled on the road, the tank platoon withdrew past it in compliance with the original orders, never having received the change in orders. A short distance after the last American tank, came the first Jap tank. Troop E, 26th Cavalry (PS) which was outposting the position and was to act as the rearguard, recognized the leading Jap tank too late to give sufficient warning and could only open fire futilely with small caliber weapons. By this time the first Jap tank had hit the assembly area along the road and all hell broke loose in the dark. Men and animals did about the only thing they could do, which was to beat a hasty retreat down the road towards Rosario. Only the action of the rear guard in burning a wooden bridge about 2000 yards west of Rosario saved the regiment from disaster, since it prevented further pursuit in the darkness by the enemy armor. As the regiment cleared Rosario it picked up the remnants of Troop F which had staved off the Jap advance through the mountains to the north. Despite the confusion, the regiment reached the Bued River position at about 2300, although with a greatly reduced effective strength.

On the Lingayen Gulf coast in the meantime, the situation of the 11th Division (PA) had deteriorated with the seizure of Damortis on 22 December. Although the main Jap effort was in the direction of Rosario in an envelopment of our right flank, a secondary enemy thrust was made to the south and part of the 11th Division (PA) was driven back to San Fabian.

The 26th Cavalry (PS) was to hold its position on the Bued River as long as possible on 23 December to allow the maximum time for the preparation of the Sison position; when forced to withdraw, the regiment was to fall back through the 71st Division (PA) into division reserve in

the vicinity of Pozorrubio. The Bued River position offered a natural barrier, although at this time of the year (the dry season), the river was by no means unfordable. The high bluffs on the east bank afforded a concealed position overlooking the river flats and the fields beyond. However, on the left (south) flank, the road ran parallel to the river between it and the overlooking cliffs, thus exposing the only route of withdrawal to direct enemy fire from the far bank. It did not take the Japs long to find this weakness and by 1000, 23 December the 26th Cavalry (PS) was forced to withdraw. This withdrawal past the junction with the road to Baguio meant the isolation of friendly troops operating in the mountains to the north. The enemy had now succeeded in completely turning the right flank of the NLF beach positions on Lingayen Gulf, with only a relatively small part of the NLF having been engaged. To assist in stopping the Jap drive on the east, the 91st Division (PA) was made available to the CG, NLF, on 23 December and one regiment of this division was immediately ordered north to reinforce the 71st Division (PA) in the Pozorrubio area. That night (23/24 December), the Sison position was heavily attacked and the 71st Division (PA) was routed. Anticipating such a contingency, the 26th Cavalry (PS) still in division reserve had been moved south to Binalonan. The enemy, however, continued his advance through the night, routing the regiment of the 91st Division (PA) on the Pozorrubio position, and moving on towards Binalonan in the early morning hours of 24 December.

Unknown to the 26th Cavalry (PS), elements of the 71st and 91st Divisions (PA) had completely abandoned their positions astride Highway 3 to the north and the cavalry regiment had now become the front-line delaying force again. Fortunately the regiment had outposted both the northern and western approaches to Binalonan where they had bivouacked. The enemy hit both outposts about 0500 on 24 December, overrunning the northern outpost with tanks. The regiment immediately took up hasty positions in their bivouac area with the two closest rifle troops cover-

ing the northern and western roads into town. The leading Jap tanks, which had taken the western road (the most direct route) to Urdaneta to the south, were met with heavy small arms fire from the 26th Cavalry (PS) and decided to bypass the Binalonan position and to continue on towards Urdaneta. The Jap infantry, on the other hand, dismounted from their trucks and attacked vigorously, but were stopped abruptly by the fire of all available weapons. Troop A in reserve was immediately thrown in on the right (north) flank in a counterattack which carried all enemy before it back to the cross-roads west of town. Here the troop ran into more enemy tanks moving south along Highway 3 and was driven back to the main position.

By this time the CO, 26th Cavalry (PS) had discovered that there were no other friendly troops in the area and that the remnants of the 71st Division (PA) had retired to the southeast to Tayug on the other side of the Agno River. He immediately had the bridge over the Tagumising River to the southeast of Urdaneta secured, and decided to withdraw via that bridge on the Asingan-Tayug Road as soon as there was a break in the fire fight. All morning of 24 December the enemy launched repeated assaults which were repulsed with heavy Jap losses. Enemy tanks in the area were apparently discouraged from any assault only by a heavy volume of well-aimed small arms fire, as the 26th Cavalry (PS) had no antitank guns. During the afternoon the enemy ceased his assaults and the regiment was able to withdraw successfully about 1530 just before the enemy launched a coordinated infantry-tank attack. Rifle troops were disengaged one at a time with the least engaged on the left pulling out first and forming the advance guard, and Troop B on the extreme right covering the final withdrawal and becoming the rear guard. The crossing of the southeastern bridge out of Binalonan was covered by the regimental scout car platoon which further delayed the pursuing Jap tanks until 1700, when the platoon was forced to blow the bridge and withdraw.

In the meanwhile, during the night of 23/24 December, the CG, USAFFE, faced with new major enemy landings in

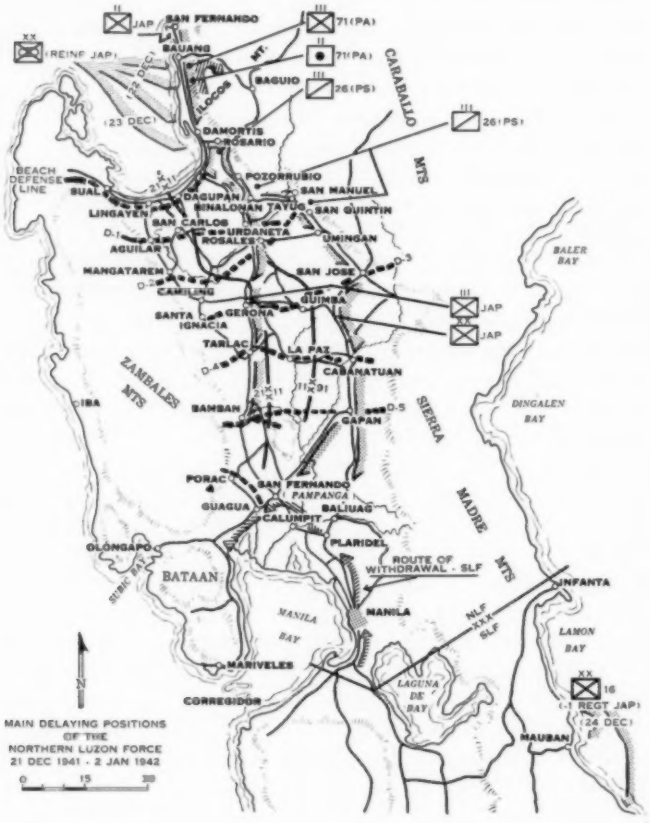
Lamon Bay east of Manila, ordered WPO-3, the planned withdrawal into Bataan, into effect. Under this war plan, the NLF was to delay the enemy advance down the Central Plains and to protect the withdrawal of the South Luzon Force (SLF) into Bataan. The Central Plains, lying between mountain ranges on the east and west, are about 40 miles in width from the head of Lingayen Gulf to the Pampanga River. (See Map 1.) Here the river splits the plains in their lower half into two narrow bottlenecks only a few miles wide, the western one of which leads into Bataan and the eastern to Manila. Five successive phase lines across the Central Plains, along which the NLF was to delay, were designated as follows (see Map 3):

D-1: The line Urdaneta-San Carlos-Aguilar.
D-2: The line Tayug-Rosales-Mangatarem, south of the Agno River.
D-3: The line San Jose-Guimba-Santa Ignacia.
D-4: The line Cabanatuan-La Paz-Tarlac.
D-5: The line Gapan-Bamban (generally taking advantage of the Bamban River as an obstacle).

The withdrawal to each of the first four phase lines was planned for specific dates. The D-4 and D-5 lines were then to be held for the maximum time to allow for passage of the SLF into Bataan and afford maximum time for preparation of the Bataan defenses.

The withdrawal to line D-1 was scheduled for the night of 24/25 December. This schedule was adhered to by the 21st Division (PA), which as yet had seen no action, and by the 11th Division (PA), which had fared badly in the Damortis area. The main route of withdrawal of the 11th Division (PA) was to have been from San Fabian to Urdaneta, (see Map 2) thence south on Highway 3, crossing the Agno River on the Carmen Bridge. Only one battalion of the division took this route. Because of the rapid enemy advance down Highway 3 on the morning of 24 December south of Binalonan, the rest of the 11th Division (PA) withdrew via Santa Barbara and made no attempt to organize the right (east) sector of line D-1, but instead moved directly to D-2, crossing the Agno River at Bayambang.

In the meantime, the 1st Battalion, 21st Infantry Regiment, which had been on detached service from the remainder of the 21st Division (PA), had already established a defensive position astride Highway 3 south of the Carmen bridge and was attached to the 11th Division (PA). While these movements were taking place, the 91st Division (PA) was preparing the defenses of its sector on the right of line D-2 from Carmen to the east. (See Map 2.)



Map 3.

On 25 December, only the 11th and 91st Divisions (PA) held the D-2 line south of the Agno River. The 71st Division (PA) had ceased to exist as a unit and its remnants were assembled in Tayug and attached to the 91st Division (PA). The 26th Cavalry (PS) was also attached to the 91st Division (PA) at this time and was given the mission of protecting the right flank of the NLF and covering the withdrawal of elements of the 91st Division (PA) in the Tayug area. The 21st Division (PA) did not withdraw to D-2 until the next night (25/26 December) at which time the remaining bridges over the Agno River were demolished.

To strengthen the D-2 position, the CG, USAFFE committed the bulk of the 1st Provisional Tank Group (192d and 194th Tank Battalions, both light tanks) in a supporting role, the tanks moving into position on 24 and 25 December. The 192d Tank Battalion was to operate in the sector of the 91st Division (PA) on the east, while the 194th Tank Battalion (less one company with the SLF) operated to the west in the sectors of the 11th and 21st Divisions (PA). Although the actions of the tanks were coordinated with other troop dispositions along the river, it was done on a basis of mutual cooperation, since the tank group came under the direct control of USAFFE whereas the divisions on the line were under NLF control. The mission assigned the tanks was to support the defense of the river line and cover the withdrawal to the next delaying position. To carry out this mission, the tanks in widely separated groups occupied forward positions along the south bank of the river. During the withdrawal, the tanks were to be the rearmost elements, regardless of whether it was a daylight or night withdrawal.

The plan of the CG, NLF was to hold on the Agno River and not withdraw until the night of 26/27 December. This could not be done on the right (east) part of D-2 as the Japs crossed the Agno River late in the afternoon of 25 December and after fording tanks across, outflanked the 26th Cavalry (PS) and forced the troopers to withdraw about 0200, 26 December. In the meantime, 91st Division

(PA) men in the area had already pulled out under cover of their own covering force and had moved south on the Umingan-San Jose Road. (See Map 3.) As the rear guard of the 26th Cavalry (PS) moved to the rear, previously prepared bridges were blown enroute. Upon arrival at phase line D-3, the 26th Cavalry (PS), exhausted from its continuous rear guard actions, went into NLF reserve and marched to the south.

In the center of D-2, the Japs did not attack until early on the morning of 26 December, when after a heavy artillery, mortar, and air preparation, they attempted to force a crossing of the Agno River in the vicinity of Carmen. (See Map 2.) Due principally to the direct fire of tanks of the 194th Tank Battalion, the enemy's crossing attempts were shattered with heavy Jap losses, and the D-2 line was held throughout the day. The men of the 11th Division (PA) holding the sector immediately west of Carmen could not withstand the heavy Jap fire however, and evacuated their positions on the afternoon of 26th December in advance of the scheduled time. At dusk the remaining PA troops in the Carmen area and 91st Division (PA) men to the east of town began their withdrawal. The 194th Tank Battalion in the meantime had been ordered to stay in position on the Agno River and not withdraw until 0500, 27 December. The same orders were intended for the 192d Tank Battalion but were never received, and so this unit withdrew at dusk. The 21st Division (PA) on the west withdrew after dark as scheduled. The 11th Infantry Regiment (PA), holding the western half of the 11th Division's (PA) sector, and the 194th Tank Battalion thus were the only remaining units on the D-2 line.

The enemy quickly crossed in the dark near Carmen and at about 1930, 26 December, seized the road center at that location. The road from Carmen to the west crosses to the north side of the Agno River at Bayambang, and there is no road on the south bank from this point on west. Thus the capture of the Highway 3 junction in Carmen left no route of withdrawal in the sector of the 11th Division (PA) other than the railroad running south from Bayambang.

Thanks to the effective road block action on Highway 3 just south of Carmen fought on 27 December by the handful of surviving tankers of the 194th Tank Battalion in the locality, the 11th Division (PA) men who had held D-2 between Bayambang and Carmen managed to escape during the night of 27/28 December by railroad train. Except for the 11th Infantry Regiment (PA), which ran its vehicles down the railroad tracks, the 11th Division (PA) abandoned its transport. Tankers of the 194th Tank Battalion in this sector, driving their tanks down the railroad tracks, also withdrew on the morning of 28 December, but upon reaching Highway 3 near Moncada found the bridges over the Tarlac River destroyed by Philippine Army engineers. Unable to ford the river, the tankers were forced to abandon their tanks. Meanwhile other tanks of the 194th Tank Battalion, which had stopped the Japs on Highway 3 the day before, had already moved back to line D-3, but the enemy had not followed up their withdrawal. (See Map 3.)

By early morning of 28 December, the rearward movement to D-3 had been completed. The pattern of the enemy advance down the Central Plains was now clear. While a reinforced Jap regiment attacked south down Highway 3 and kept frontal pressure on the NLF, the enemy main body, about a division in strength, advanced along the axis of Highway 5, continually threatening to envelop the right flank of the NLF. (See Map 4.)

Encountering only a few enemy patrols along phase line D-3 on 28 December, the NLF withdrew to phase line D-4 during the night of 28/29 December according to schedule. Facing the enemy astride Highway 3 was the 21st Division (PA), while the 91st Divsion (PA) blocked Highway 5 and the 11th Division (PA) held the center of the line. At the D-4 position, the Pampanga River split the front of the NLF and separated the 91st Division (PA) on the south bank of the river from the rest of the NLF.

The Japs hit hard on 30 December, launching a coordinated attack against the D-4 line, with the main effort directed against the 91st Division (PA) at Cabanatuan on the right. The 91st Division (PA) was defeated and

driven back ten miles to the vicinity of Gapan, where the enemy again attacked early the same night. A complete rout resulted, the disorganized survivors of the 91st Division (PA) finally being rallied about 20 miles further to the south on Highway 5. Meanwhile, the Jap secondary effort at Tarlac on the left had made no headway against the 21st Division (PA). However, with the collapse on

Map 4.

the right of the D-4 line, the right flank of the 11th Division (PA) was exposed to enemy attack, and so the CG, NLF, ordered that the withdrawal to a modified D-5 line be made. The 21st Division (PA) and the 11th Division (PA) were to hold the modified D-5 line, running gen-

erally south of the Bamban River, and resting its west flank on the Zambales Mountains and its east flank on the great swamp east of the Pampanga River. On the other side (east) of the river, a separate defensive line was organized by 31 December astride Highway 5 south of the Maasin River. Here remnants of the 91st Division (PA) were reinforced by the 71st Division (PA), consisting of about one regimental combat team, which had been reorganized. (See Map 4.)

At this juncture, the CG, SLF, was ordered to expedite the withdrawal of his troops from south of Manila into Bataan, and to clear the Calumpit Bridge on Highway 3 over the Pampanga River by 0600, 1 January 1942. The enemy realized the vital importance of the Calumpit Bridge bottleneck and renewed his attack on the morning of 31 December. On the right, the Japs tried to force a crossing of the Maasin River near Highway 5, and on the left, Jap Cavalry occupied Bamban and probed outposts of the 21st Division (PA) north of the Bamban River.

That same morning (31 December), the CG, SLF, was ordered to assume command of all forces east of the Pampanga River to coordinate the movement across the Calumpit Bridge. To give added protection to the SLF withdrawal route, a reinforced regiment of the 51st Division (PA) (from the SLF) took up a position on Highway 5 just north of Plaridel. About noon on 31 December, through a misunderstanding of orders from Headquarters NLF, riflemen of the 91st and 71st Divisions (PA) withdrew from the Maasin River position on Highway 5 and the Japs followed up quickly, occupying Baliuag. To slow down the Jap advance at this critical moment, one company of the 192d Tank Battalion (SLF) launched a counterattack at about 1700. The enemy was surprised and so disorganized that he did not resume his movement along Highway 5 until early 1 January.

All night long, 31 December—1 January, troops of the SLF streamed across the Calumpit Bridge thence north into San Fernando (Pampanga), and then headed south for Bataan. At dawn, as the rear guard of the SLF passed

over the bridge, the advance guard of the Jap column which had driven down Highway 5 came into sight. Troops of the 91st Division (PA), which had been holding a small bridgehead on the east bank of the river, were then withdrawn and the bridge demolished. Meanwhile, during the same night (31 December—1 January), troops of the 11th and 21st Divisions (PA) completed their withdrawal to the modified D-5 line.

Foiled at the Calumpit Bridge, the enemy now turned his full attention on the San Fernando bottleneck and directed both his air and ground efforts at that objective. One Jap column peeling off from Highway 5 near Gapan advanced on San Fernando from the northeast. This movement was stopped on 1 January 1942 near Mexico by the 71st Division (PA), which had withdrawn across the Pampanga River the day before, and the 194th Tank Battalion. About 1330, 1 January, the Japs forced a crossing of the Pampanga River near the Calumpit Bridge and began their advance on San Fernando from the south. In view of the proximity of these enemy threats, the CG, NLF ordered that the withdrawal from the D-5 line be executed that night, 1/2 January, via Angeles and Porac. In the meantime, friendly troops were to hold the Japs southeast and northeast of San Fernando until the withdrawal from the D-5 line had been completed. This withdrawal came just in time, as on the left, Jap cavalry, moving through the eastern foothills of the Zambales Mountains, had outflanked the 21st Division (PA). By morning, 2 January, however, all elements of the NLF had safely reached the Porac-Guagua line, a new defensive position guarding the approaches to Bataan.

The NLF had now successfully accomplished its delaying and covering mission, but at a heavy loss, approximately 12,000 of its original strength of 28,000, or about 40 per cent of the command. On the opposing side, the Japs, who had counted on a quick, overwhelming campaign on Luzon, two weeks long at the most, faced the prospect of attacking our concentrated forces on excellent defensive terrain. Because of their failure to destroy the NLF and prevent

the concentration of the Filipino-American forces in Bataan, the Japs were compelled to alter their time-table of Pacific conquest and to reinforce heavily their troops on Luzon. Even then, it was not until 8 April 1942, over three months later, that they were able to overrun the defenders of Bataan.

CRITICAL ANALYSIS

In many respects, the conduct of these operations left much to be desired. However, comparing our relatively untrained and inadequately equipped troops with the veteran Japanese mechanized forces opposing them, the action of the Filipino-American troops which made the gallant defense of Bataan possible are truly remarkable. Two critical phases stand out: one, the series of delaying actions fought by the 26th Cavalry (PS) from Damortis to Tayug which foiled all Jap efforts to turn the NLF's right flank; and the other, the action of the 194th Tank Battalion in stopping the enemy penetration on Highway 3 south of Carmen. Had either of these units failed to stop the enemy, in all probability, there would have been no Bataan. The enemy would have split our Luzon forces hopelessly and then destroyed them piecemeal.

The over-all plans of the NLF appeared to be sound, only the execution was at times faulty. The successive phase lines selected across the Central Plains for the delaying action took advantage of natural obstacles and were far enough apart to force the enemy to reorganize and displace his artillery before continuing his advance. At first glance, the delaying positions might seem to be too far apart. Separating them some distance, however, proved to be a wise decision, as it gave the untrained troops involved more time and space for reorganization.

Control and coordination, which are all-important in a delaying action, particularly in the withdrawal phase, were lacking many times. Contributory factors were the failure of commanders and staffs to get information and orders to their commands, and the fact that green troops often abandoned their positions without a fight. The lack of field communications only partly explains the failure to dessemi-

nate orders, since such matters can be transmitted by staff and liaison officers, messengers, or commanders themselves. For secrecy's sake, the latter means of transmitting a withdrawal order are preferable.

The necessity for attaching to front-line units all other units operating in an area during a retrograde movement was forcibly illustrated in the delaying action along the Damortis-Rosario Road and again on the Agno River. In the former instance, the failure to attach the tank platoon present to the 26th Cavalry (PS) was almost fatal to this regiment. On the Agno River, the fact that the tank battalions operated independently from the divisions on the line was partly reponsible for the uncoordinated withdrawal which facilitated the Jap river crossing. It also resulted in the abandonment of approximately one company of tanks, out of a total of two tank battalions present on Luzon, a serious loss. Not only did this independent employment of tanks preclude a coordinated withdrawal, but it also deprived local delaying force commanders of their only effective antitank weapons as well as their only real counterattacking force.

The presence of higher commanders in critical areas is particularly important in rearward movements not only for reasons of command, but also to offset the adverse effect on morale which such movements have on the men. A good example of this took place just east of the Calumpit Bridge on Highway 3 where both the CG, NLF, and the CG, SLF, personally got together on the ground and coordinated the final withdrawal across the bridge.

Demolitions and obstacles were used extensively, but mines were not used, as they were not available to our troops. Improvised mines could have been employed making use of the demolition materials on hand. Such mines would have been invaluable in delaying the Jap armor against which our troops had no effective antitank weapons.

The importance of flank security, especially on an open flank, cannot be over-emphasized in a retrograde movement, as the enemy will constantly and relentlessly try to strike withdrawing columns on their flanks, and to get in

their rear and cut their escape routes. An excellent example of this is the action of the 26th Cavalry (PS) along the Damortis-Rosario Road where one-fourth of the rifle strength of the regiment was employed to protect its exposed north flank which was also the north flank of the NLF. This disposition, although seemingly extravagant in view of the small forces available, saved the regiment from being outflanked and possibly destroyed during the first day of the delaying action.

The employment of tanks was not altogether sound. Not once were our tanks furnished close-in infantry protection, nor was the powerful infantry-tank team ever exploited. On the contrary, tanks were ordered to remain in position in the dark after all other troops had departed, and then to cover the withdrawal with no infantry support whatsoever. On the Agno River line, two tank battalions (minus one company), almost the entire tank force on Luzon, were employed in forward positions on the south bank, on a front of about 50 miles, with no tanks held in mobile reserve.

Secrecy, vital to a successful movement to the rear, seemed to have been compromised from the outset of the campaign. American PW's captured early in the game testified that their Japanese interrogators knew more about the details of WPO-3, including the location of delaying phase lines, than they did themselves. Numerous Filipino fifth columnists were active in the rear of our troops throughout and undoubtedly were of great help to the enemy in pin-pointing our dispositions and movements.

Although the operational planning of the campaign was satisfactory, the over-all logistical planning for the support of the Bataan defenses appeared to be lacking. Several priceless weeks elapsed after the outbreak of hostilities before any major effort was made to remove supplies from the port area in Manila and from Fort Stotsenburg. Even then, no maximum coordinated effort was made to move these valuable supplies, large amounts of which remained in Army warehouses in central Luzon and never reached Bataan.

On the other side of the picture, the Jap was slow to

react to the true situation on Luzon. His original scheme of maneuver in the Central Plains, which was to envelop our right flank, was religiously carried out despite several opportunities to crack through our center. At Binalonan and again at Carmen on Highway 3, the Japs failed to realize and exploit the weakness of our positions in the center, but instead persisted in making their main effort around our right flank. Apparently the enemy had a preconceived idea that our ground defenses were stronger than in actuality, and that we had large reserves in the Clark Field-Fort Stotsenburg area capable of a counter-offensive. Hence he was wary of trying to penetrate our center and concentrated on enveloping our forces.

In the air, the Jap was also characteristically single-minded in purpose. Enemy bombers never deviated from their assigned targets, no matter what lucrative targets of opportunity presented themselves. This was particularly true at the Calumpit Bridge and San Fernando bottlenecks where Jap air lost several opportunities to strike massed columns of retreating men and vehicles. Calumpit Bridge would have been an ideal objective for an enemy airborne force, but again the Japs failed to make the most of their advantage.

CONCLUSIONS

Untrained, ill-equipped troops, no matter how superior in numbers, cannot be expected to stand up against trained troops with modern arms and equipment. On the other hand, trained and disciplined units with determined and resourceful leaders who refuse to concede defeat, can fight effectively even when lacking adequate weapons and equipment to cope with the enemy. In any event, sound tactical principles boldly executed by aggressive leaders can make the most of a bad situation.

The soundness of our doctrine with regards to retrograde movements was forcibly demonstrated in this operation. Where time-proved principles were correctly applied, effective delaying action and successful withdrawals were

accomplished. Where cardinal principles were violated, failure and near disaster resulted.

The importance of coordination and liaison, between all echelons, laterally as well as up and down the chain of command, and particularly among front-line units, cannot be overemphasized. Placing all units in the forward areas under the control of front-line unit commanders will facilitate this coordination. However, over-all control of the retrograde operation must be rigidly exercised by the over-all commander to achieve a coordinated operation. Lacking that over-all control, the commander is inviting confusion and perhaps a disorderly rout.

Aggressiveness, boldness, and maintaining the initiative are as essential to successful defensive and retrograde operations as they are to the offensive. Effective delay cannot be imposed against an enemy through passive methods of resistance. An outnumbered force can successfully delay a superior force by carrying the fight to the enemy. A highly effective way to delay the enemy is to attack him, particularly the flanks of his advancing column. Thus, an enemy column, vigorously attacked by a much smaller force, is compelled to carry out time-consuming deployment and maneuver to determine the real strength of our attack.

The principles and mechanics of retrograde movements must be studied and practiced in peace, if they are to be successfully conducted in war. Despite plans to the contrary, our country may again be caught unprepared for war. Our troops in being, therefore, should have a working knowledge of rearward movements, as some day their entry into combat may be an operation of such a nature.

Airborne Training Cycle

Capt Jack Tallerday, Infantry

Foot-slogger or parachutist, the Infantryman's mission is the same—to close with and destroy the enemy by fire, movement, and close combat. But the man with the wings overcomes obstacles of time and distance to hit the enemy with the greatest surprise and the least delay.

The Infantry School has been producing this brand of soldier since June 1940. In August of that year, the first test unit, 42 enlisted men and two officers, made its first jump. Since that time the school has qualified more than 125,000 airborne soldiers who, together, have made over 850,000 jumps.

Until January 1946 airborne training aimed at parachute qualification. Since then training has become more inclusive and now the student learns to enter combat by glider, powered aircraft, or parachute. Not only infantrymen, but artillerymen, and members of other supporting services learn to use this modern means of transportation.

The Basic Airborne Course is a rigorous five-weeks of training. Its students are volunteers—enlisted men and officers. They learn air transportability techniques, parachute techniques, and are familiarized with pathfinder and aerial delivery methods.

Officers take the same course and are assigned to the same company as enlisted men. Officers and enlisted men work alongside each other in all phases of instruction. Officer rank is respected, but all ranks are co-equal as students. Some Navy and Marine personnel are enrolled to learn the skills of their companion service. However, most of their training is concerned with air transportability.

The Basic Airborne Course stresses safety. Rugged, strenuous training conditions the student mentally and

physically for jumping from aircraft. The success of this program is evident from the present injury rate—.04 of one per cent. Perfection of training and equipment has reduced the injury rate steadily from the rate for 1942 which was 6% for the year with a high one month of 13%. An injury as defined in these rates is *any* injury which requires medical treatment. They range from minor sprains and bruises, which constitute the majority, to more serious types. The following table shows jumps per year with the average yearly injury rate.

Fiscal Year	*Number Students Graduating*	*Total Student Jumps*	*Injury Rate*
1940-41	255	1,275	
1941-42	6,617	33,085	6%
1942-43	24,163	120,815	5%
1943-44	27,406	137,030	1%
1944-45	29,469	147,345	1%
1945-46	8,977	44,885	.5%
1946-47	11,745	58,725	.2%
1947-48	6,291	31,455	.1%
1948-49	8,682	43,410	.05%
*1949-50	1,949	9,745	.04%
Total	125,544	627,770	

*1 July 1949 to 9 January 1950

The injury rate decrease is even more striking when shown graphically. (See Figure 1.)

During the first week of the Basic Airborne Course the student receives air transportability training. He becomes familiar with cargo aircraft, flight rules, and safety precautions. He learns the history of airborne operations, how to compute loads, and the theory of lashing. Demonstrations and practical work in loading and lashing heavy equipment lets him put into practice what he has learned. (See Figures 2, 3, and 4.) At the end of the week he takes an orientation ride in a glider, completing his training with that type of aircraft.

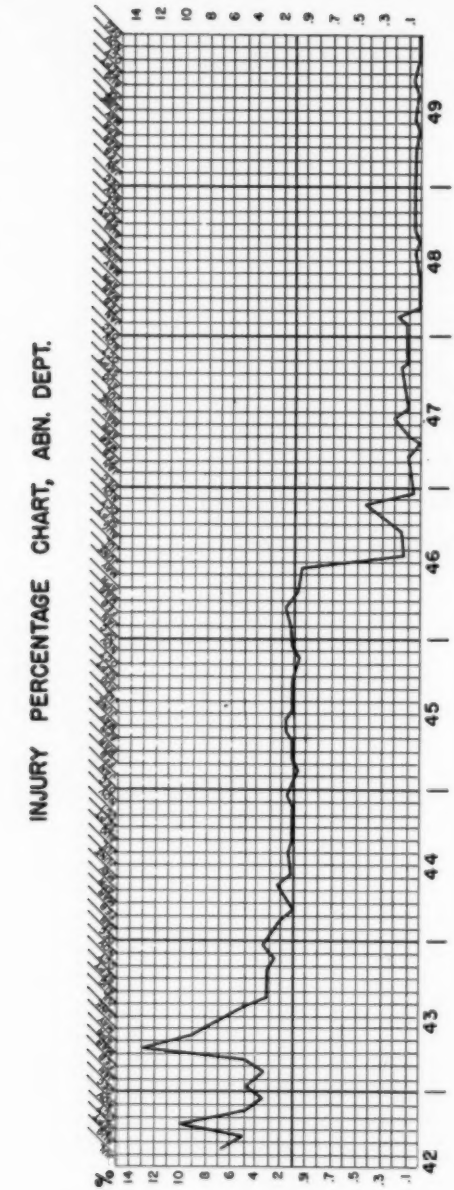


Figure 1. This injury percentage chart speaks for itself - it shows a record of decreasing injury rates of which The Infantry School is justly proud.

Figure 2. The student learns to tie the various knots used for lashing cargo and equipment in aircraft.

Figure 3. He learns how to load vehicles quickly and safely by practicing on full-scale aircraft mock-ups.

Figure 4. He practices loading and lashing vehicles and other equipment into stripped glider frames.

Emphasis on physical training begins right at the start of the course. Close order drill, runs, and calisthenics begin the physical build-up which continues throughout the five weeks. (See Figure 5.)

Figure 5. Physical conditioning is climaxed in the fourth week by a Physical Fitness Test. The score made by the trainee indicates whether he is physically fit to jump.

The second week of training has two objectives: first, learning four of the five basic jump techniques; second, better physical conditioning. This week inaugurates the actual parachute training. The student learns the seven jump commands—the commands given by a jumpmaster to get his jumpers out of an aircraft. The student learns to GET READY, STAND UP, HOOK UP, CHECK EQUIPMENT, SOUND OFF FOR EQUIPMENT CHECK, and STAND IN THE DOOR. He learns and practices those commands and the first jump techniques on the mock-up of a C-82 aircraft. At the final command, GO, he jumps up and out of the mock-up door, dropping about three feet to a sawdust pit. (See Figure 6.)

The student progresses to the second technique, taught on the 34-foot mock-up tower. Here he first experiences the sensation of being suspended in the air after jumping from a considerable height. The student gets into a harness, is checked by an instructor, and double-times up the stairs to the top of the 34-foot tower. Here his harness is hooked onto risers which are attached to a trolley on an overhead cable slanting from the top of the tower toward the ground.

He is ordered to STAND IN THE DOOR and GO. He sounds off his roster number, receives a tap on the shoulder from the instructor and exits from the tower door. The trolley, to which his risers are attached, slides down the cable, carrying him toward the ground. He lands on

Figure 6. The instructor commands "GO" and the student jumps up and out of the mock-up door. Instructors grade him on each of the seven jump commands.

Figure 7. Learning the second jump technique, the student exits from the door of the 34-foot tower. Here is where he first experiences the sensation of jumping from a considerable height. Ten percent of each class is eliminated here.

a sawdust mound, is unhooked from the risers, and double-times back to the base of the tower where he receives a grade for the jump. Instructors tell him exactly what he did wrong and how to correct it. Ten percent of each class is eliminated at the tower stage. They either refuse to jump or "freeze" and can't jump. (See Figure 7.)

Since a strong enough ground wind will keep a chute inflated and drag a jumper, he must know how to control the parachute after landing. This is the third technique taught in this second week of training. He learns two control methods: The "Bottom Riser Method" in which the bottom risers are pulled in toward the jumper's body, collapsing the chute; and "Recovery from the Drag" where he turns his body in order to get on his feet and runs around the parachute to collapse it. (See Figure 8.)

Figure 8. A student learns how to control his parachute after landing. A strong wind from the wind machine keeps the chute inflated.

The last technique taught during this second week is *landing*. Jumping off a two-foot platform, the student simulates a parachute landing fall. He learns to bend his body like the rocker on a rocking chair, to rotate the upper portion of the body away from the fall, and to distribute the landing impact over five points of contact: the balls of the feet, the calf, the thigh, the buttocks, and the "pushup muscles"—the large muscles covering the shoulder blades.

Physical training continues, the body building process speeding up as the repetitions of each exercise are increased.

During the third and fourth weeks of training the novice parachutist receives further technical training from the Tower Training and Pack-Jump Training Groups. He and his fellows continue to be hardened physically in a bal-

anced program designed to cut the injury rate. Physical conditioning is climaxed during the fourth week by a Physical Fitness Test which gives an over-all indication as to whether or not the trainee is physically fit to jump. A modification of the usual physical fitness course is designed for field grade officers who are 35 or older.

This third and fourth week period sees the aspiring jumper progressing from individual to team performance. He works again on a 34-foot mock-up tower—this one built to permit jumping a four man stick from either of its two doors. At the end of the fourth week students jump without individual commands.

During this period students make the acquaintance of another training device—suspended harness. (See Figure 9.) Working in this harness, hanging above the ground, trainees learn to control a chute from the time of exit until the landing. They also learn the steps to take in cases of emergency landings. Along with this training they progress in their practice of parachute landing falls. They move up from the two-foot to a four-foot parachute landing fall platform and they wear full equipment while practicing their falls.

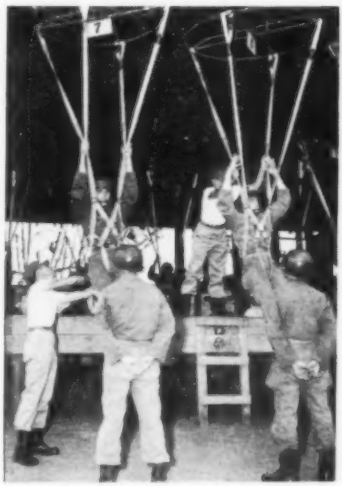


Figure 9. Working in a suspended harness the student learns how to control his chute from exit to landing. Highly experienced instructors teach, check, and correct each man's technique.

It is in the third week that the student experiences his first parachute descents. He is suspended from a parachute which is pulled to the top of a 250-foot "control" tower. He drops from that height, his lateral movement controlled by cable, but his vertical descent free. His rate of descent depends on his weight and the wind velocity at the time. He learns the technique of releasing a reserve chute and he is checked on his parachute landing fall technique.

As the jumper goes aloft on the control tower he assumes an exit attitude. Automatically released at the top, he makes his exit count, "one thousand, two thousand, three thousand," then pulls his reserve parachute rip cord. He drops 18 feet in his risers when the parachute again checks his fall and he continues his descent.

Finished with his control tower instruction, the student progresses to the free towers. These, also, are 250-feet high, but once a jumper's chute is released from the top, its fall is completely free. During his descent the student follows the directions of his instructor whose voice comes to him amplified by a public address system. (See Figures 10 and 11.) The instructor grades him closely on his descent and determines whether his progress is sufficient to permit him to enter the fifth, the live-jump, training week.

Figure 10. Students make free parachute descents from these 250-foot towers. An instructor, using a public address system, advises them and corrects their techniques as they fall.

Equipment and conditions in free tower training are designed to give the student confidence and get him to concentrate on techniques. Large, 32-foot parachutes are used; they have specially constructed vents to reduce oscillation; and the field at the base of the towers is plowed to produce an easier landing.

Figure 11. A jumper lands after one of his descents from the free tower. He will soon learn whether his progress warrants his advancement to the live-jump training phase.

Concurrently with other training in this third and fourth week period, students learn the technique of assembly after landing, and they become familiar with, and use, pathfinder assembly aids and aerial delivery methods and equipment. (See Figures 12 and 13.)

Figure 12. A pair of students becoming familiar with a radio-compass beacon, one of the "pathfinder" devices which guide aircraft to their drop-zones.

Fifty hours of instruction on parachute packing are spread through the third, fourth, and fifth weeks of the

course. (See Figure 14.) This fifty hours on parachute packing is one-quarter of the training time for the entire course. But this large time allotment is necessary since every student packs his own chute for each of the five qualifying jumps in the final week of instruction.

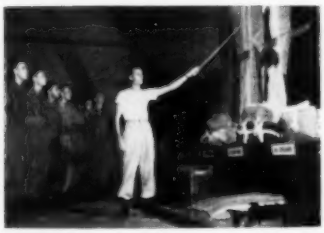


Figure 13. An instructor points out some of the parachutes used for aerial delivery of men and supplies. On the counter are some of the bundles containing supplies, which can be dropped by parachute.

These five qualifying jumps that top off the Basic Airborne Course are made from aircraft in flight. Each jump is slightly different from any other one. The first three are made from an altitude of 1200 feet— the last two from 1000. They differ, too, in the manner of exit and the number exiting at one time.

Figure 14. Packing parachutes. Each student packs the chutes with which he makes all his live jumps. Fifty hours of the 200-hour course are spent on chute-packing.

The first jump is an "eight-man tap-out." In this type jump each man is tapped on the shoulder by an instructor and given the command GO before his exit.

The remaining four jumps are mass exits in which the first man is tapped and given the command GO and the others follow without further command.

The second of the five jumps is an 11-man mass exit from the right door; the third, a 16-man mass from the left door; the fourth a 32-man mass, with 16 men each using the left and right doors. The side on which a man exits is determined by the side on which he has been seated during the flight. Those seated on the left jump from the left door; those on the right use the right door.

The fifth—the last jump—is a 32-man mass just like the fourth except that the men jump with full field equipment and execute an assembly problem after landing.

Before each flight the student-packed chutes are inspected by an instructor. (See Figure 15.) The jumper is checked to see that his parachute is donned correctly, that all straps are untwisted, and that breast and leg strags are inserted in a "quick release box"—a device which permits the jumper to release himself from his chute speedily once he has landed. His reserve parachute receives a thorough going-over at this time, also.

Figure 15. Ready for their first "live-jump" these students receive the final thorough inspection of their parachutes before going aloft.

Novice-jump flights are non-tactical. Aircraft follow established flight patterns taking off from Lawson Air Force Base, which adjoins the Main Post at Fort Benning, and proceeding several miles to the actual jumping area. On the drop zone signals are sent and control is maintained with a large panel—an arrow 40 feet long and 10 feet wide. Signals pass from ground to air by means of SOP signals with this panel.

Despite the intensely repetitious nature of the training, human error can creep into these final phases of the air-

borne course. Some men, unnerved by anticipation of the jump, forget some of their instruction after leaving the plane. To bring them down to earth—literally and figuratively—a powerful public address system is used to inform jumpers of malfunctions of their main canopy, their proximity to other jumpers, and to instruct them to use their reserve parachutes, if necessary.

After enplaning, the novice jumpers are under orders from jumpmasters—members of the Jump Committee of the Airborne Department's Pack-Jump Training Group. The jumpmaster is responsible for the students' safety enroute to the jump field and for jumping the students over the panel on the field.

When the plane is about three minutes from the field, the pilot signals the jumpmaster by means of a red light near the door from which the jumpers will exit. On this signal, the jumpmaster begins his series of commands used to prepare for and execute the jump. GET READY prepares the jumpers for the commands that follow. STAND UP brings the men to their feet, facing the door. HOOK UP - and they attach their static lines to the cable inside the plane. CHECK EQUIPMENT sets the men to checking equipment. SOUND OFF FOR EQUIPMENT CHECK insures the jumpmaster that students are ready to jump. When the aircraft is over the area designated for the jump, he commands STAND IN THE DOOR. After the men have moved up to the door and the first man is ready to jump, the jumpmaster, at a time designed to land his jumpers at the right place, commands GO and the student exits. All his previous airborne training is put to use in his five "live-jumps."

After successfully completing this last week of training, students, now full-fledged paratroopers, graduate in a formal ceremony at which each man is presented with his silver wings. (See Figure 16.)

Students from all types of organizations, located wherever the Army serves, volunteer for this training. They arrive as individuals. The enlisted men's backgrounds vary from that of recruit with three months' service, to master

sergeant with long service—often including extensive combat. Their demeanor and previous training are equally varied. This heterogeneous group is welded into a company. After five weeks of the Basic Airborne Course, this company emerges a proud, disciplined organization with the highest esprit. Students have learned confidence in their equipment and confidence in themselves. Along with self-satisfaction and pride in their organization goes the satisfaction of having mastered another military technique.

Figure 16. Full of pride and the satisfaction of a new technique mastered, the student becomes a full-fledged paratrooper and is awarded his silver parachute badge at a formal graduation ceremony.

Experienced instructors are the key to success in this training. Almost all instructors, both enlisted and officer, are veterans of World War II airborne units. They have a wide knowledge of airborne skills. Selected carefully, and trained for their jobs, they are familiar with the problems of airborne operations and work constantly to keep abreast of changing techniques and modification of equipment.

A good many of these instructors come from units such as the 82d, 11th, 17th, and 101st Airborne Divisions—or ganizations with outstanding war records; but neither instructors nor students live in the past. Rather, they build for the future.

It is a future which the adherents of airborne believe is limited only by the ingenuity of its leaders and national resources and production capabilities.

These troops, by their means of entry into combat, strike the enemy at his weakest and most vulnerable location. An airborne army is a tactical as well as a strategical threat to any aggressor nation. Combined with air power it may be the decisive element in any future war.

The Parachute Maintenance Company **by Captain William J. Hojnacki—its organization and mission—coming in the October QUARTERLY.**

Your Photomap

Maj John D. Foulk, Infantry

Can you make a photomap from an aerial photograph or mosaic? Yes, and you don't have to be a technician to do it. Apply a few simple rules, use a pencil, protractor, and coordinate card or improvised field expedients and you can make an aerial photograph or mosaic into a photomap.

Why do we want a photomap rather than a plain aerial photograph? Because we need a grid system, a scale, and directions on our photographs to help us locate points, and to determine distances and directions. A grid system helps us to identify points on the photograph; a scale helps to determine distances, and direction permits us to orient our photograph and determine the grid-magnetic angle.

Let's assume a situation. You are a rifle company commander and you are going to attack through another unit that is on line. Enemy resistance does not permit ground reconnaissance other than a glimpse of the terrain from a concealed observation post. You have 24 hours to prepare for the attack and a messenger from battalion has just delivered 10 copies of an aerial photograph that covers your zone of advance. You look at the photographs and wonder how you can talk to battalion about certain terrain features and unit locations—without a grid system. However, you remember that provisions have been made for just such occasions and it comes under the title of "Point Designation Grid System" or the abbreviated term, *PD Grid*. You decide to make your own photomap.

To establish a PD Grid system on your aerial photograph, whether it be a mosaic or a single photo, you first hold it so that the photo legend is in the normal reading position. Now divide the photo in half vertically. Do this by folding and

then marking the center, or by measuring and then drawing the center line, or by using the fiducial (or reference) marks that most aerial photographs have on their borders. If you use the fiducial marks, be sure to use the wing of the arrow as shown in Figure 1. Now mark this line *A*.

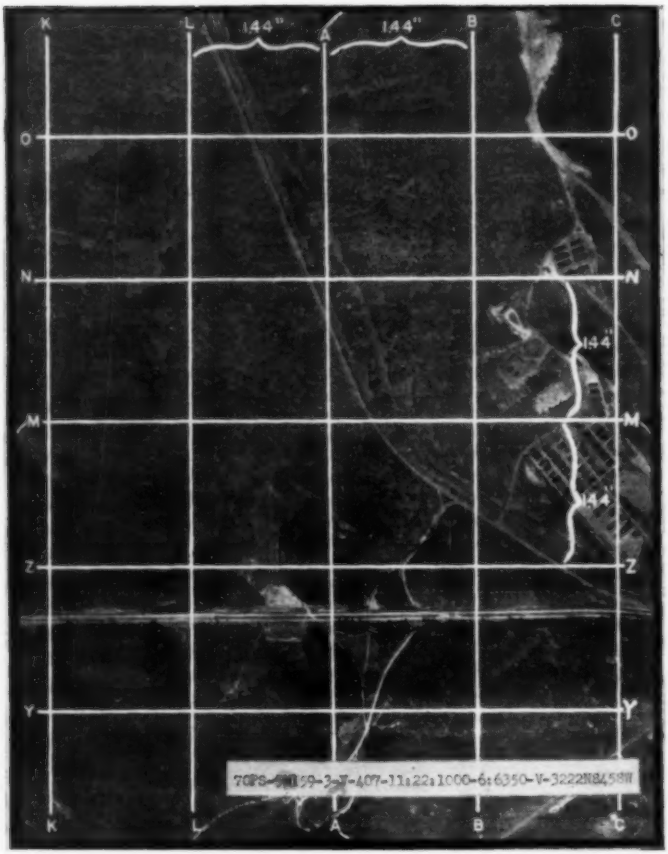


Figure 1. How to Plot and Letter Your PD Grid.

Next, divide the photo in half horizontally in the same manner and mark this line *M*. These lines are the origin from which you can build the remainder of the grid lines. FM 21-26 states that the grid interval for the PD Grid system is 1.44 inches. A convenient measuring device is a *yard* coordinate card, scale 1/25,000. (The interval from 0 to 10 on the card is 1.44 inches long.) Of course, a ruler or some improvised field expedient can be used. Next, begin at line *A* and measure to the right and left a series of lines 1.44 inches apart. Be sure that you start at line *A* and work outward. When you have done this, repeat the process starting with line *M*. Again be certain that you start from line *M* and work up and down. When you have drawn your lines, your photo will have a grid system on it and the only item missing is the letters of the grid lines. Starting with line *A*, you letter to the right—B, C, D, E, F, through G. If you have more grid lines in that direction you can start over with a double B, i.e., *BB*, then *CC*, and so forth. (FM 21-26 makes no provision for this situation.) Next, starting with *A* again, you work to the left, backwards through L, K, J, I, and H. Again if there were more grid lines we could start over with a double L, i.e., *LL*. Now start at line *M* and letter up, N, O, P, Q, R, through S. If you do not have grid lines for all the letters, you omit those that you do not need, but always start from lines *A* and *M* as we have discussed. Now letter down from line *M*, starting with Z, X, W, V, U, through T. When all grid lines are lettered, you have completed your PD Grid (see Figure 1). Remember this, the PD grid system is an arbitrary grid, has no relationship to scale, and is used only to locate a point on your aerial photograph or mosaic.

To read a coordinate by using the PD Grid system, you read right-up. Let's say you read right to *B* and up to *Z*. By putting those two letters together you have located grid square *BZ*. Then by using a 1/25000 yards coordinate card, or any means that you may have of measuring coordinates, you obtain the remainder of your reading, still reading right-up. Your finished coordinate reading will look like this—BZ2561. To locate a point at LY3125, you first locate

grid square LY, then read right 31 and up 25. With this completed PD grid system you can send coordinates to someone miles away; if he has placed the PD grid on his photo or mosaic, he can locate the point to which you refer.

So far we have reached the point where you can call your battalion commander and refer to a point on the photo by coordinates, provided he has placed the PD grid on his aerial photograph. He can converse with you, issue orders, talk about the terrain, and in general discuss intelligently any point on the photograph.

Let us now assume that you want to know the distance from your LOFD* to your objective, both straight line and road distance. By applying a few rules you can find the representative fraction of your aerial photograph and then compute a graphic scale. Let's first discuss the methods of obtaining this representative fraction.

There are three primary ways to find the scale of an aerial photograph. The quickest, if it is available, is to use the data in the photo legend. A typical photo legend appears like this: 70PS-5M159-3-V-407-11:22:1000-6:6350-V-3222N8458W (A sample is shown in Figure 1.) The part we are interested in is the *6:6350* because the 6 is the focal length of the camera which is always expressed in inches, and the 6350 is the altitude of the plane *above sea level,* which is always expressed in feet.

If, however, the average height of the terrain is 100 feet above sea level you must adjust by subtracting 100 from the altitude of the plane. This enables you to obtain the height of the plane above the ground. You then apply a simple formula to determine the RF (representative fraction) of the photo.

$$RF = \frac{\text{Focal length of the camera}}{\text{Height of the plane above the ground}}$$

*LOFD is the abbreviation for "Line of Departure" recently adopted by the Department of the Army.

In this case RF =

$$\frac{6''}{6{,}350' - 100'} = \frac{6''}{6{,}250' \times 12} = \frac{6''}{75{,}000''} = \frac{1}{12{,}500}$$

(6,250 is multiplied by 12 to convert the denominator to the same unit as the numerator—to inches.)

Therefore, you now know that one inch on the photograph equals 12,500 inches on the ground.

Another method of obtaining the RF of your photo is by comparing photo distance with ground distance. For example, suppose that you have an aerial photograph of the ground you're on. You locate two features on the photo and then locate those same two features on the ground. Then you can find the RF by applying this simple formula RF = $\frac{\text{photo distance}}{\text{ground distance}}$. First you measure the distance between the two points on your aerial photograph. Assume that to be 6 inches. Now you measure the distance between those same two points on the ground and find that to be 1,000 yards. (You can pace it off, use a vehicle, or estimate the distance.) Now all you do is insert those figures into your formula:

$$RF = \frac{PD}{GD} = \frac{6''}{1{,}000\ \text{Yds}} = \frac{6}{1{,}000 \times 36} = \frac{1}{6{,}000}$$

(1,000 is multiplied by 36 to convert the denominator to the same unit as the numerator—to inches.)

Another method of obtaining the RF is by comparing your aerial photograph with a map of the same area. First, locate two points on your photo which you can find on the map, then measure the distance on each. If the photo distance is 4 inches, and the map distance is 2 inches, and the RF of the map is 1/25,000, we again use our formula RF = $\frac{PD}{GD}$. We know the aerial photograph distance is 4 inches, but we do not know the ground distance. To determine this we can measure 2 inches on the graphic scale of the map and find the distance in yards. However, we know that one inch on the map is equal to 25,000 inches on the ground; therefore, 2

inches is equal to 50,000 inches on the ground. Using the latter method our formula would appear like this:

$$RF = \frac{4''}{2'' \times 25{,}000} = \frac{4''}{50{,}000''} = \frac{1}{12{,}500}$$

Either of the above methods of finding the RF is accurate enough for field use. For convenience, it is best to bring the denominator to the nearest 100. For example, if you determine the RF to be $\frac{1}{7{,}240}$, use $\frac{1}{7{,}200}$.

You have now determined the RF of the aerial photograph. If you want to measure distance by using a graphic scale, you can compute one in this manner:

If the RF of the aerial photograph is $\frac{1}{50{,}000}$ and we want to compute a graphic scale for 1,000 yards, this is how it can be done:

$$RF = \frac{1}{50{,}000} = \frac{x}{1{,}000 \text{ Yds}}$$

$$50{,}000x = 1{,}000 \text{ Yds} \times 36$$

$$x = \frac{36{,}000}{50{,}000}$$

$$x = 0.72 \text{ inches}$$

That means that 0.72 inches on the aerial photograph equals 1,000 yards on the ground. By drawing a line 0.72 inches long on the aerial photograph and then dividing it into 10 equal parts, you have a scale divided into 100 yard segments. This graphic scale is used the same way as one on a map.

So far you have constructed a grid system, computed a scale, and constructed a graphic scale. The last item that you need on your aerial photograph is a magnetic north direction; once you have that, you can determine the GM angle.

To do this, if you are on the ground, all you need to do is locate two points on your aerial photograph that you can identify on the ground. Then, using your compass, read the magnetic azimuth from one of these points to the other (see Figure 2). Find these two points on the map and connect

them with a line. Using a protractor, or some field expedient, place the index on the point from which you measured the azimuth and place the scale in the direction you are measuring. For example, let's suppose you've read an azimuth of 100 degrees. (See Figure 3). Place the index of the protractor on the point from which you are measuring, with 100 degrees on the line connecting the two points. Now draw in the magnetic north arrow, which runs along the base of the protractor.

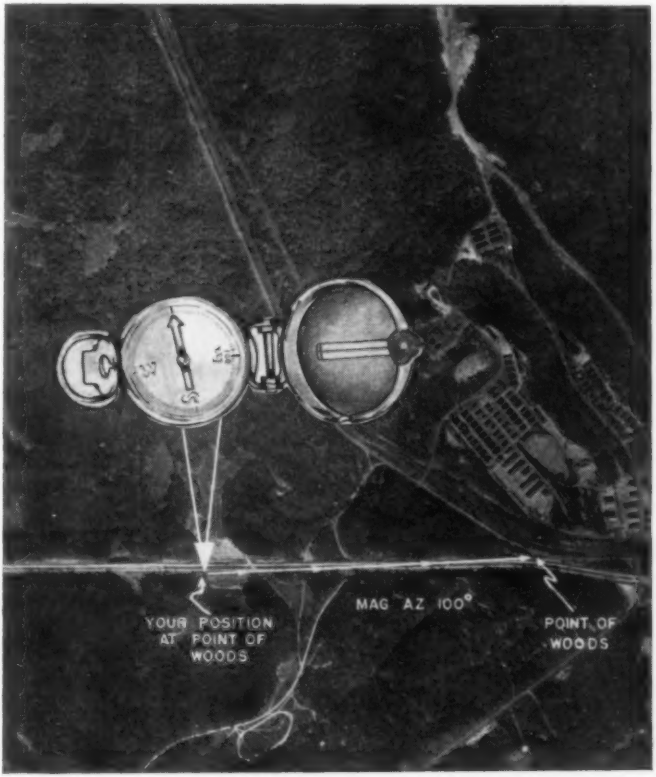


Figure 2. Obtaining a Magnetic Azimuth Between Two Points.

If you are not on the ground, you can use a map of the area to get a magnetic azimuth. First find the grid azimuth between two points on the map. Then change the grid azimuth to magnetic azimuth by applying the GM angle for the map. Once you have obtained the magnetic azi-

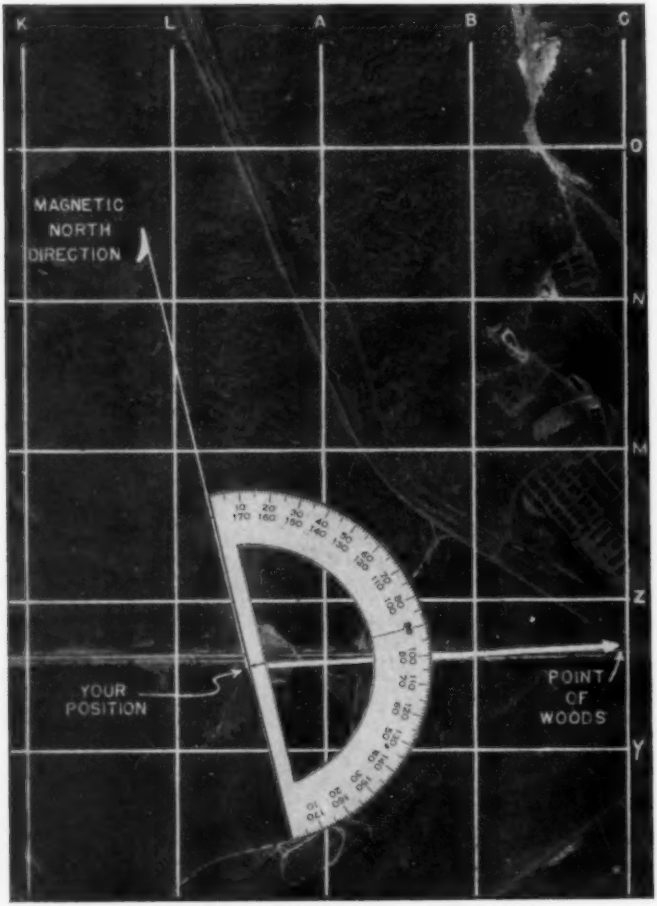


Figure 3. Plotting the Magnetic North.

muth for the map, you can plot magnetic north on your aerial photograph.

For example suppose your map shows a magnetic azimuth of 90 degrees from one point to another. Find the same two points on your photograph. You know that the mag-

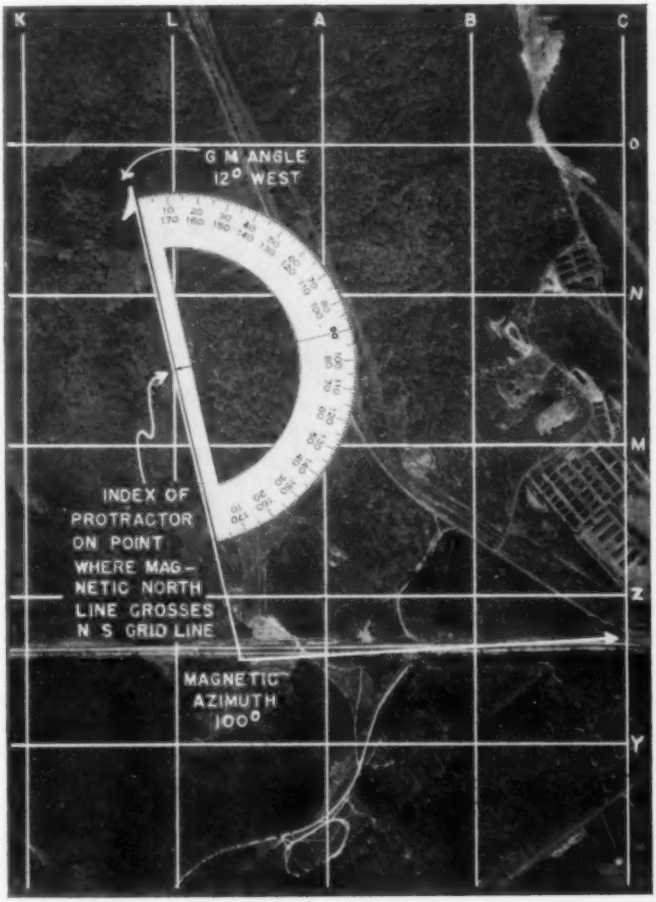


Figure 4. Finding the G-M Angle.

netic azimuth from the first point to the second point will be the same on the photo as it is for the map. Connect the two points with a line on your photo. Place the index of your protractor on the first point and then turn the protractor until the line intersects the scale at 90 degrees. Draw a line along the base of the protractor. This is your magnetic north-south line.

The last and final step which will make your aerial photograph into a photomap is determining the "Grid-Magnetic Angle." (See Figure 4.) This is done easily in one of two ways. First you can extend the magnetic north arrow line until it crosses a north-south grid line. Now place the index of the protractor on the point where the magnetic north arrow crosses the north-south grid line. Aline the base of the protractor either on the north-south grid line or the

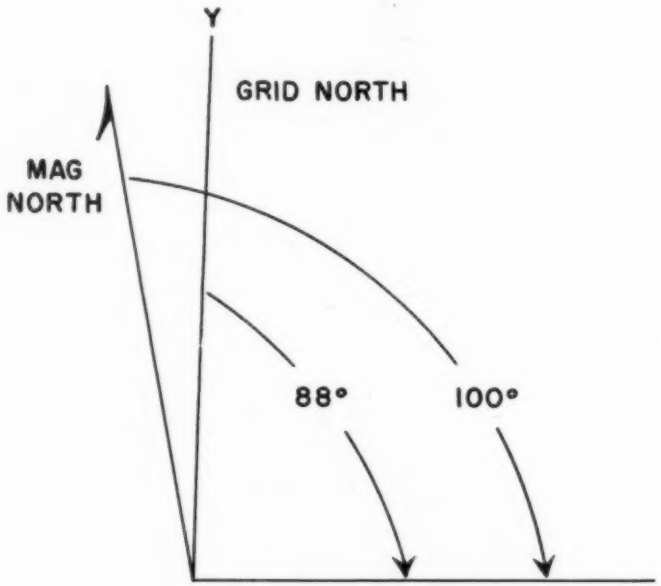


Figure 5. Another Method of Finding the G-M Angle.

magnetic north arrow line. Now read the angle between the two lines which gives you the GM angle. By looking at magnetic north (see Figure 4) and grid north on the photo, you can determine if the GM angle is east or west. The other method is to read the grid azimuth of a line and then the magnetic azimuth of the same line. (See Figure 5.) By subtracting one from the other and by drawing the picture, the same as you do in map reading, you can determine whether the GM angle is east or west. For example, if the grid azimuth of a line is 88 degrees, and the magnetic azimuth is 100 degrees we can draw the picture shown in Figure 5.

Then, 88 subtracted from 100 gives us 12 degrees and the direction is west; therefore, the GM angle is 12 degrees west. (See Figure 5.)

SUMMARY

Getting back to our original situation, we can see how, by applying a few rules, with only a pencil, protractor, and coordinate card, or improvised field expedients, we can make an aerial photograph or mosaic into a photomap. We can now refer to a point on the photomap by coordinates, we can measure distance either by using the RF or graphic scale, and by using the GM angle we can convert grid azimuths to magnetic azimuths, and vice versa. In other words, our photomap is now ready to be used in place of a map or in conjunction with a map.

Plain English

Lt Col Harry W. Stephenson, Jr., Infantry

This is an article about plain English. It tells what's being done to make more readable training literature. It also has some suggestions for your writing—suggestions based on The Infantry School's writing policies.

The Infantry School's manuals and articles are written and edited by Army officers. This military writing is not (except in the case of a certain type of article) intended to be dramatic and exciting. The manuals have no plot and characterization. Their one purpose is to give you military knowledge in plain language.

That's the School's job—getting the material down in easy-to-understand English. You'd be surprised how difficult it sometimes is. Later in this article you'll see examples of the progress we hope we're making.

Here is an extract from the December 1949 INFANTRY JOURNAL's editorial on The Infantry School's writing:

> "Two things we learned at Benning that struck the most responsive chord when we reported it to the JOURNAL staff were these: The Infantry School has the deepest interest in modernizing its writing and getting out of the old rut of dull 'official' phraseology. * * *
>
> " 'Official' writing can be any kind of writing, good as well as bad. Its writers, to apply an old but just legal comment, have always been able, unable, or lamentable. The stuff turned out and officially printed and distributed can be readable, unreadable, or miserable. But we found the School intent on greater readability—found it turning to Rudolph Flesch's, THE ART OF PLAIN TALK* and his even better new book, THE ART OF READABLE WRITING*, as the best modern guides to American writing.

*THE ART OF PLAIN TALK, 1946, price $2.50, and THE ART OF READABLE WRITING, 1949, price $3.00, both published by Harper and Brothers, New York. (The Infantry School Book Department has these in stock.)

"Plain writing is not just a fanaticism of ours. We argue for it, plead for it, pray for it, because it will make a better Army. It could save millions of man-hours per year. But above all, it could make the learning of all military knowledge easier and faster and more interesting."

And so it could. Have you ever tried to wade through, much less understand, a stiff, formal, wordy, verbose, cluttered, vague, ambiguous, article or document? The words for such work are "gobbledygook" and "Federalese." Those who write it may not do much harm in civil life, where people can read it or let it alone. But in the Army its practitioners obstruct knowledge like a blindfold obstructs vision.

Soon you will be using new and recently revised field manuals that are more readable. The material in them has been reworked 3 to 5 times. Unnecessary words have been deleted; so have statements that lend themselves *to more than one interpretation*—an old bugaboo. Here are some examples, *Old* and *New*. See which you like better.

OLD

FM 23-30—HAND AND RIFLE GRENADES—ROCKET, AT, HE, 2.36-Inch. (14 February 1944.)

"1. TYPES. Hand grenades are divided into the following types:

a. Fragmentation grenades, containing an explosive charge in a body designed to fragment with the action of the bursting charge.

b. Offensive grenades, containing a high explosive charge in a paper body, designed for demolition effect.

c. Chemical grenades, containing a chemical agent which produce a toxic or irritant physiological effect, a screening or signal smoke, an incendiary action, or any combination of these.

d. Practice grenades, containing a reduced charge, to simulate fragmentation grenades.

e. Training grenades, contain no explosive or chemical."

NEW

FM 23-30 HAND AND RIFLE GRENADES (April 1949)

"2. WHAT IS A GRENADE? A grenade is a small bomb. (See Figure 2.) It may be filled with either explosives or chemicals, or it may be an empty chamber used for practice in throwing (practice grenades).

Hand grenades are of various sizes, shapes, and types. The type of hand grenade you select to use depends on what you want the grenade to do.

If you want an effect like the explosion of a shell, you use a FRAGMENTATION grenade. When this grenade explodes, it hurls pieces of metal fragments around an area of about 30-foot radius. The grenade shown in Figure 2 is a fragmentation grenade.

If you want an effect like the exploding of dynamite, you use an OFFENSIVE grenade. As shown in Figure 3, the OFFENSIVE grenade is nothing more than a small package of explosive with a fuze attached.

If you want to set fire to something, or if you want to use gases or smoke, then your choice is a CHEMICAL grenade. As shown in Figure 4, the CHEMICAL grenade is a small container filled with chemicals and has a fuze attached.

Later we will discuss in detail the individual types of grenades.

So we can better understand how all grenades do their jobs, let us take a look at their three main parts."

OLD

FM 7-30—SUPPLY AND EVACUATION—THE INFANTRY REGIMENT; SERVICE COMPANY AND MEDICAL DETACHMENT (1 June 1944):

32. EXPLOITATION AND BATTLEFIELD RECOVERY. a. **General.** Weapons, equipment and material, pertaining to both enemy and friendly troops which are disabled, partially worn out, captured or abandoned, must be placed in supply and maintenance channels in order that this material can be used immediately, or be repaired and re-issued. Besides making available considerable quantities of supplies for re-issue, such action conserves equipment and material and lessens the burden on transportation and supply systems. * * * "

NEW

FM 7-30—SERVICE AND MEDICAL COMPANIES INFANTRY REGIMENT (September 1949):

"47. BATTLEFIELD SALVAGE AND EVACUATION. a. Unit commanders are responsible for salvage discipline. This includes gathering and moving salvage to collecting points, which are located along supply routes. Troops collect damaged, discarded, abandoned, or captured property and equipment. Items in excess of unit needs are turned in to supply agencies. The collection of salvage makes substantial quantities of arms, equipment, and supplies available for re-issue, and this reduces loads on the supply and transportation facilities. * * *"

OLD

FM 21-75—SCOUTING, PATROLLING, AND SNIPING (6 February 1944):

"1. IMPORTANCE. Commanders must have accurate, detailed, and timely information about the enemy, the terrain and neighboring troops for successful combat. Well-trained scouts and capably led patrols are among the agencies which furnish them such information."

NEW

Draft FM 21-75—COMBAT TRAINING OF THE INDIVIDUAL SOLDIER AND PATROLLING (Not yet printed):

"PURPOSE AND SCOPE OF PART I

1. This is a guide for you, the soldier, regardless of your arm or service. It explains how to go about your duties as a soldier in daylight and darkness. It shows you how to protect and preserve your health and how to see at night. It also teaches you the technique of sniping and shows how combat intelligence helps you. It explains how to write a message and how to be a messenger."

We think you'll agree that the NEW versions are easier to read and follow. This is because the language is simpler and *talks right at you.* You have a feeling of being let in on something. Many more OLD and NEW examples could be printed here, but three are enough to make the point.

What brought about this change? In late 1947, The Infantry School started revising many of its tactical manuals, and it was decided that language and style would be simplified and would follow comparable civilian methods—those to which the reader was already accustomed in magazine stories and articles. And then, in June 1948, General Devers, Chief of Army Field Forces, directed that training literature be clear and understandable to the readers for whom it was intended. He recommended Flesch's book, THE ART OF PLAIN TALK, as a guide. This book and THE ART OF READABLE WRITING are very helpful guides. Here are some common-sense statements from them.

*

The *more syllables* there are in a word, the harder it is to understand.

*

The *more words* there are in a sentence, the harder it is to read and understand that sentence.

The *more words about people* there are in a passage, the more interesting it is to read.

*

The *more sentences addressed to an audience* there are in a passage, the more interesting it is to read.

Flesch shows you how to measure your writing's readability. For example, STANDARD style writing can be understood by 83% of the people—those with eighth grade education or its equivalent. STANDARD writing averages 17 words per sentence and 147 syllables per 100 words.

The Infantry School has a writing SOP to guide its writers. Here are parts of it:

*

We don't write down to anybody, and we don't write up to anybody. We clearly and simply express thought so that it can be understood equally well by *both* private and general, by eighth graders and college graduates.

*

If a simple, well-known word will do it, use it. This improves readability. The following is a guide only: (Complete list covers several pages.)

INSTEAD OF THIS	*TRY THIS*
takes appropriate measures	acts; does
afford an opportunity	allow
deliver an assault	assault
initiate	begin
with the exception of	except
with due regard for safety precautions	for safety
in a manner similar to that	like
in compliance with order for a commander	omit (presumed)
take whatever steps are necessary	do
in a situation which	when

*

The excessive use of *must, will,* and *should* is monotonous, and lessens the clarity and force of what you are writing. Use uncomplicated sentences that state fact *in the active voice.*

*

Usually, several re-writes are necessary to achieve clear, concise text. Considering the number of people who will read and study military training literature, your time will be well spent.

*

There is a lot more to The Infantry School's writing SOP, but enough has been set down here to give you the idea. (If you want a free copy of the 15-page INFANTRY SCHOOL WRITING SOP, drop a line to the QUARTERLY editor. You'll get one by return mail.)

THE FUTURE OF PLAIN ENGLISH

Now you know about plain English and The Infantry School's writing policies. Start using plain readable English in your own writing and watch the improvement. Just remember to:

KEEP YOUR SENTENCES SHORT.

WRITE SPOKEN ENGLISH—USE COMMON SHORT WORDS.

USE THE ACTIVE VOICE.

USE MORE VERBS.

CUT OUT DEADWOOD—THE PREPOSITIONS, CONJUNCTIONS, AND ADVERBS.

Eventually all our military writing will be plain English. It's inevitable because we've got to save the training time now spent in interpreting manuals, orders, letters, and regulations. If enough of us believe in plain readable English and use it—the trend will gain momentum. There may even be a Department of the Army Directive on it.

Wooden Working Models—BAR

Capt Frederick H. Black, Jr., Infantry
and SFC Coats Brown

If a picture is worth a thousand words, a working model should be worth ten thousand. Subscribing to that theory, The Infantry School uses working models to teach the functioning of small arms. The QUARTERLY plans a series of articles on the construction and use of these models starting in this issue with the Browning Automatic Rifle.

In teaching the BAR, The Infantry School uses working models of the operating group, trigger group, and buffer and rate reducing group. So that your unit can reproduce these models, detailed dimensional drawings are shown with this article. It also contains instructions for building the models and the procedures used in applying them to instruction.

The models presented here are large enough to permit their use with classes of up to 200 men. To further increase their value, all parts are painted in distinctive colors. The choice of colors is left up to the builder. Colors should be vivid and adjacent parts should offer as much color contrast as possible for easy differentiation. When the same part appears in more than one model it is painted the same color wherever it appears.

Mount all models for the same weapon on stands that are the same height. This permits the instructor to show more clearly the inter-relation of the various groups. In some cases, two or more groups can be made to work together as they do in the actual weapon.

Since these are *working* models, accuracy of construction is important. If the parts aren't the right sizes, they may not work.

Materials consist of wood (scrap lumber for the most part), nails, screws, easily constructed hardware, and a few lengths of ordinary screen door spring.

Hard wood, such as oak or maple, is recommended for parts that are subjected to strain. Screws are better than nails for assembling parts.

Most of these working models are not constructed exactly like the parts they represent. For simplicity of construction some details have been eliminated.

The operating group working model is much simpler than the same group in the actual weapon. Designed to show the functioning of the parts of the group, it lacks some of the refinements necessary in the weapon. Some parts are cut away to show parts in rear of them (notably the bolt lock which has a cutout portion to permit seeing the tang and rear portion of the firing pin.) (See Figures 1, 2, and 3.)

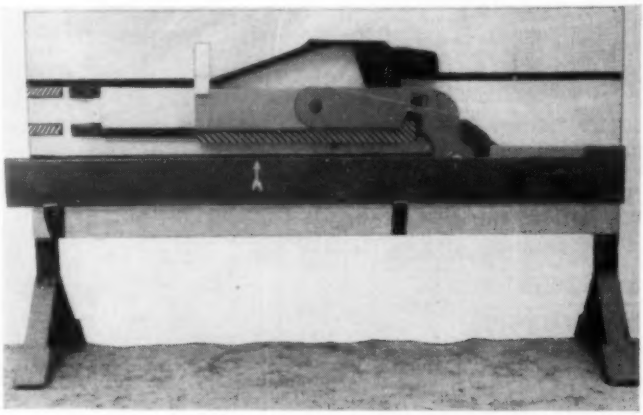


Figure 1. Operating group model; bolt in rear position.

On the actual group the firing pin goes all the way through the feed rib. (Feed rib shown with diagonal stripes in Figures 1, 2, and 3.) On the model, however, the firing pin does not extend all the way through the rib, but is only long enough to stay in place. (See Figure 3.)

The buffer head and sear release are not a part of this model. The portion of the model (block on right lower corner of model) represents the buffer and head and sear release.

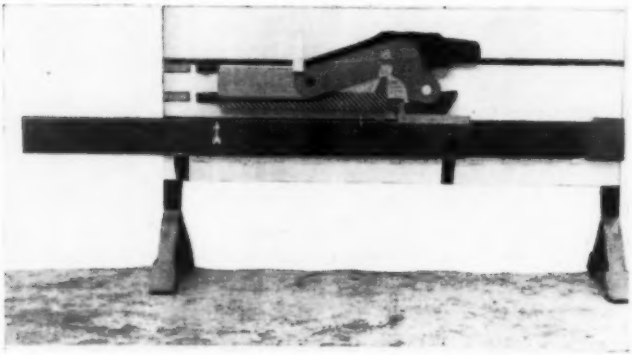


Figure 2. Operating group model; bolt forward.

Paragraph 21, FM 23-15, describes the steps of functioning of the operating group. In the first phase (rearward movement) there are seven steps:

1. Action of the gas.
2. Movement of the slide.
3. Withdrawal of the firing pin.
4. Unlocking.
5. Extraction.
6. Ejection.
7. Termination of rearward movement.

The operating group model is particularly useful in explaining steps 2, 3, 4, 5, and 7.

The movement of the slide involves two actions: compression of the recoil spring and withdrawal of the center rib of the hammer from the firing pin. To show this withdrawal and the rearward movement of the slide, grasp the handle and pull the slide slowly to the rear.

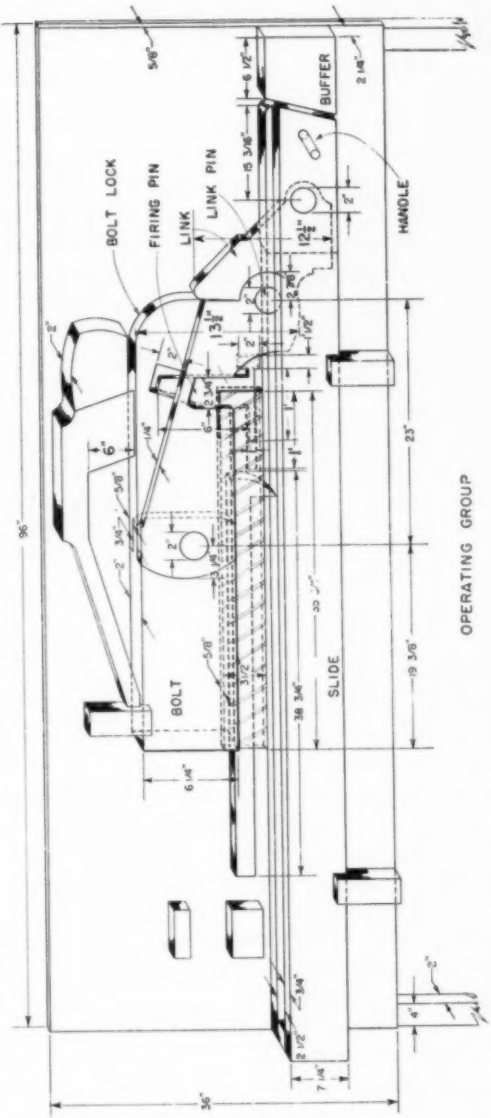


Figure 3. Detail drawing of operating group model.

During the forward movement the firing pin was driven a short distance through the feed rib. Show its withdrawal during the rearward movement by drawing the slide slowly to the rear, pointing out to the class how the slot in the underside of the bolt lock moves down over the tang of the firing pin. Show the cam surface of the slot acting on the cam surface of the tang to move the firing pin to the rear.

When teaching unlocking, discuss its three aspects—when unlocking starts, what takes place during unlocking, and when unlocking stops. You can show all this vividly on the model. Unlocking begins when the hammer pin passes directly under the bolt link pin. Show it by moving the slide slowly to the rear until this condition exists. Continue moving the slide rearward until the bolt link buckles forward and downward about the hammer pin causing the bolt lock to be withdrawn from the locking recess. Continue the movement of the slide to the rear until the bolt lock is all the way down and all the parts are moving to the rear at the same speed.

When discussing extraction, first explain that immediately after a round is fired the empty case is sealed against the walls of the chamber. In order to avoid a ruptured cartridge case, the case has to be loosened in the chamber by a slow initial extraction. Show this on the model. As the bolt lock moves down from its locking recess, point out that the circular cam surfaces on the under side of the bolt lock operate on the rounded rear shoulders of the bolt supports. The resulting lever action loosens the case with a slow, powerful initial extraction. The empty case and extractor are not included on the model.

Since the rounded, rear shoulders of the bolt supports are subject to much wear, a stripping of tin has been added to their surfaces to reduce wear on the part.

Show the last step, termination of the rearward movement, by simply moving the slide completely to the rear. The rear of the slide strikes the block representing the buffer head and sear release and the movement stops.

Most of the five steps in the forward movement can be shown as easily and as thoroughly on the model as those steps in the rearward movement. The forward movement includes:

1. Action of the recoil spring.
2. Feeding.
3. Locking.
4. Ignition.
5. Termination of the forward movement.

Steps 1, 3, 4, and 5 can be illustrated and demonstrated on the operating group model.

During the rearward movement the recoil spring is compressed, storing up the necessary energy for the forward movement. The recoil spring is not shown on the model, but its action, the first step in forward movement, and its purpose can be illustrated by moving the slide forward manually.

Each of the three phases of locking can be shown on the model. Locking commences as the circular cam surfaces contact the rounded, rear shoulders of the bolt supports. To show this, move the slide forward slowly until the above condition exists. Point out what takes place. As the slide is moved further forward, the bolt-link buckles upward and to the rear about the hammer pin. This action forces the bolt lock up into the locking recess. Next, move the slide a short distance until the hammer pin is directly under the bolt-link pin. At this point locking ends.

As you cover ignition of the cartridge, emphasize that the tang of the firing pin is buried in the slot on the under side of the bolt lock whenever the bolt lock is down out of its locking recess. In this position the center rib of the hammer is locked from the head of the firing pin. Illustrate this by drawing the slide to the rear. Then, move the parts forward again. The bolt lock moves up into its locking recess. The head of the firing pin is now exposed to the center rib of the hammer. The parts continue forward and the center rib of the hammer strikes the firing pin driving it through the feed rib. The striker strikes and ignites the cartridge. To show this, move the slide forward

slowly, allowing the center rib of the hammer (painted on the bolt link) to strike the firing pin.

The forward movement is terminated by the forward shoulders of the slide contacting the rear shoulders of the gas cylinder tube. This action cannot be completely shown on the model since the rear shoulders of the gas cylinder tube are not present. You can, however, move the slide forward to illustrate a portion of the final phase.

The trigger group model (see Figures 4 and 5) has six moving parts: trigger, slide, sear, sear release stop lever, change lever and change lever bar, and connector. To assist in constructing the model, parts have been drawn separately in Figures 6 and 7.

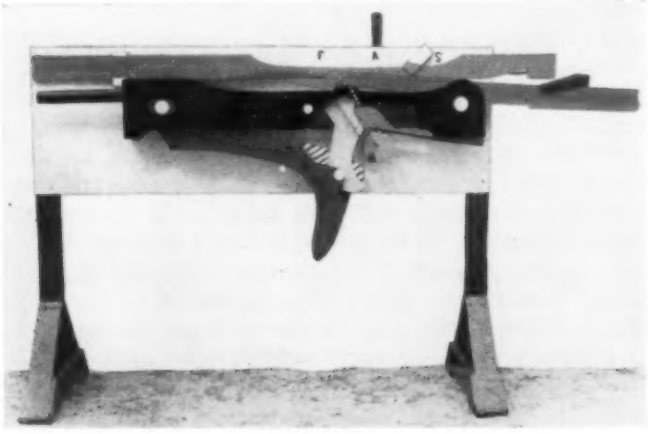


Figure 4. Trigger group model; slide forward.

This is a spring actuated model. The two outer leaves of the sear spring hold the sear down until the trigger is manipulated. Another spring, connected at one end to the rear of the slide and at the other end to the backboard, pulls the slide forward when the sear nose is released from the sear notch in the slide. A third spring connects the trigger and the connector.

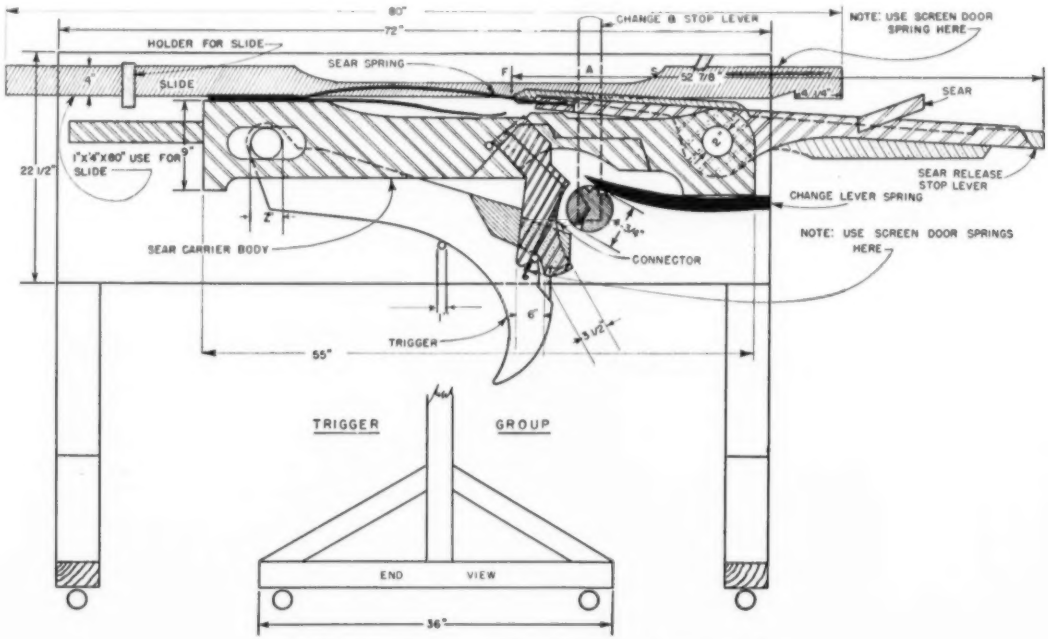


Figure 5. Detail drawing of trigger group model.

The sear spring is made from a sheet of 1/8-inch spring steel cut to the dimensions indicated in the drawing. Ordinary screen door springs are used on the slide, and between the trigger and connector.

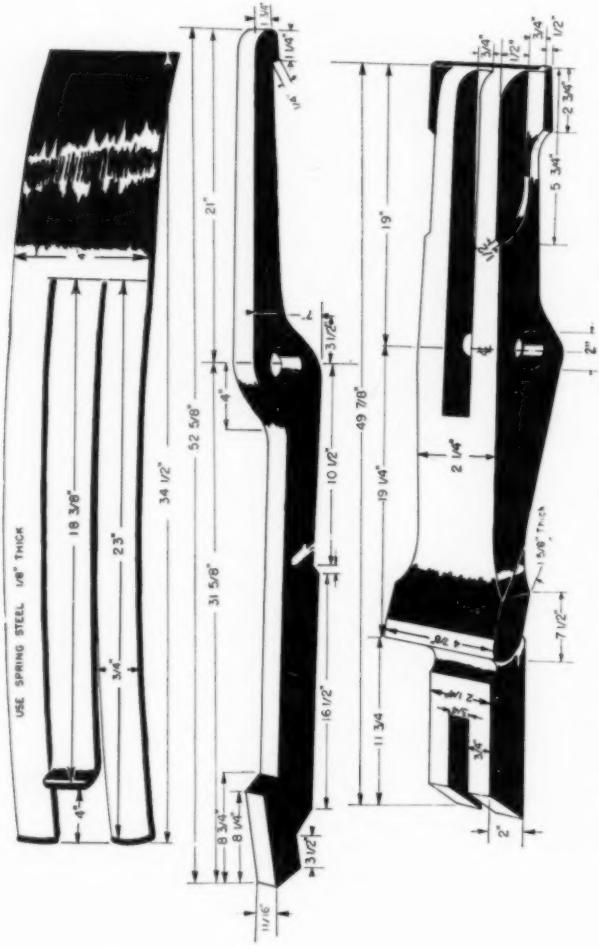


Figure 6. Detail drawings of sear spring, sear release stop lever, and sear.

Manual operation moves the slide to the rear until the notch engages the sear.

One shoulder of the trigger has been cut away to show the lower end of the connector. The upper end of the connector can be seen through the cut away side of the sear carrier. (See Figure 4.)

Instruction on the trigger model is presented in three steps: The "S" (safe setting); the "A" (normal cyclic rate) setting; and the "F" (slow cyclic rate) setting. (An assistant instructor is required to help the instructor use this model most effectively. The assistant manipulates the trigger while the instructor points out the action that takes place.)

The instructor explains the operation of the change lever and change lever bar and moves the bar extending above the top of the model to show the action. Point out that on the "S" setting the solid portion of the change lever bar is exposed to the shoulders of the trigger. Have the assistant press the trigger. Show the class that the connector does not move up since the trigger shoulders are blocked by the solid portion of the change lever bar. The slide remains engaged with the sear and the weapon does not fire.

Now show what happens on the "A" setting. Set on "A", the cut away portion of the change lever bar and the tongue of metal in the cut away portion are exposed to the shoulders of the trigger and the toe of the connector respectively. As the trigger is pressed the shoulders of the trigger move up into the change lever bar. This forces the connector up which in turn raises the forward end of the sear and sear release stop lever. The connector is kept from falling forward by the toe of the connector contacting the tongue of metal on the change lever bar. This, too, is illustrated on the model. As the sear and sear release stop lever pivot about the sear pin, the slide is released from the sear and moves forward under action of the compressed recoil spring (represented by the spring on the rear of the slide). As long as the trigger is held to the rear, the rear end of the sear and sear release stop lever are depressed.

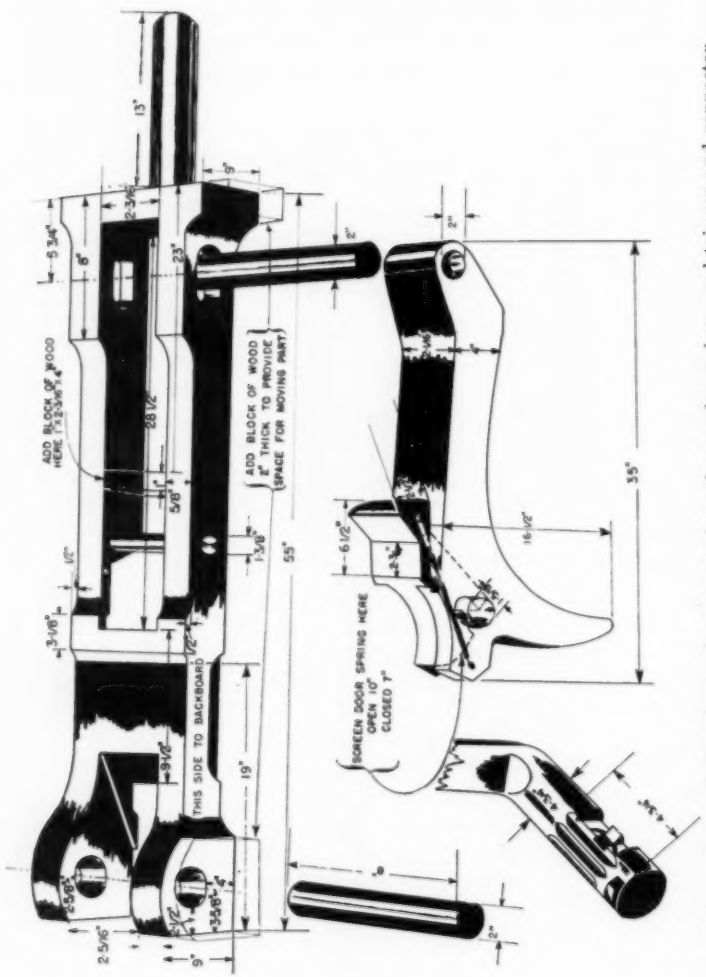


Figure 7. Detail drawings of sear carrier, change lever bar, and trigger and connector.

In the actual loaded weapon the operating parts then continue to move back and forth firing the weapon at 550 rounds per minute since there is nothing to hold the slide to the rear. To show this action on the model, start with the slide to the rear. Press and hold the trigger to the rear allowing the slide to snap forward. When the trigger is released the two outer leaves of the sear spring reposition the sear. The connector and trigger are repositioned by the center leaf of the sear spring. The sear release stop lever spring repositions the sear release stop lever.

As the change lever is moved to the "F" setting, the cut away portion of the change lever bar rotates downward and to the rear. The cut away portion remains exposed to the shoulders of the trigger. However, the tongue of metal which previously had held up the toe of the connector has moved from the path of the connector. To show this action on the model, simply move the change lever back and forth several times between the "A" and "F" setting.

The procedure in handling the model during the discussion of the "F" setting is similar to that for the "A" setting.

1. Since the toe of the connector is not blocked by the tongue of metal on the change lever bar, the connector will fall forward against the connector stop.
2. The connector initially raises the forward end of both the sear and sear release stop lever and then is cammed out from under the forward end of the sear release stop lever. The sear release stop lever is repositioned by the sear release stop lever spring. The forward end of the sear is still held up by the connector.
3. The slide hangs up on the sear nose upon coming to the rear after each shot.

The sear release strikes the actuator which in turn moves to the rear through the actuator tube. The movement to the rear and the forward movement are shown by the instructor's manually operating the parts. He does this by grasping either end and moving the actuator in the desired direction. As the actuator comes forward the sear release is struck. On the model the sear release does not move forward suf-

ficiently, nor hard enough, to perform its function of depressing the rear of the sear. The rear of the sear is depressed manually to simulate the function of the sear release.

When using this model, the rate reducing portion of the buffer and rate reducing group is best discussed in conjunction with the trigger group. The rate reducing portion includes the sear release, actuator, actuator tube, and actuator spring. As the instructor explains the "F" setting on the trigger group he refers to the slide striking the buffer head and sear release. The slide then moves forward a short distance and hangs up on the sear nose. Show this on the model. It is at this time that the rate reducing parts function. When the sear release is struck, it in turn strikes the actuator which moves to the rear through the actuator tube. Since the actuator spring is merely painted on the backboard, the instructor explains how it would be compressed by the actuator. As the actuator is driven forward by the expanding actuator spring, it strikes the sear release. The sear release in turn strikes the rear, cammed extensions of the sear forcing the rear of the sear down. This action as mentioned above is accomplished manually. As a result of this action the sear nose is disengaged from the sear notch and the operating parts snap forward firing another round. This particular phase should be demonstrated several times to allow the class to grasp the action of the parts involved on both models.

4. Each time the slide comes to the rear it strikes the sear release and buffer head. This action brings the buffer and rate reducing group into play.

This last point (4) shows the close relationship between the functioning of the trigger and the buffer and rate reducing groups. Functioning of the buffer and rate reducing group is divided logically into two parts—the buffer and the rate reducing portions. The rate reducing group is the only portion involved in the functioning of the trigger group. The two wooden models can be placed together before the class and used in conjunction with each other. The models should be placed so that the trigger model is an ex-

tension of the buffer and rate reducing model. In this position the rear of the slide strikes the sear release and buffer head as it moves to the rear.

The important point to keep in mind while discussing functioning of the trigger group is the relationship between the change lever bar, the shoulders of the trigger, and the connector. With this information as a basis the remainder of the discussion is relatively simple.

On the buffer and rate reducing group model, the following moving parts are represented: four sets of brass cups and steel cones, sear release, buffer head, and actuator. (See Figures 8 and 9.)

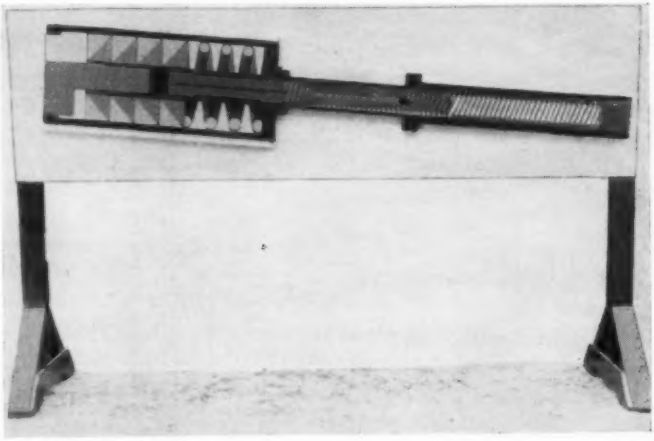


Figure 8. Buffer and rate reducing group model.

Not all the parts are movable. The buffer spring, actuator spring, buffer tube, actuator tube, and the actuator tube and buffer cap assembly are all painted on the training aid.

The model is completely manually operated. The buffer head and sear release move to the rear as they are struck by the slide on the trigger group model. The buffer head strikes the first brass cup forcing it over its steel cone.

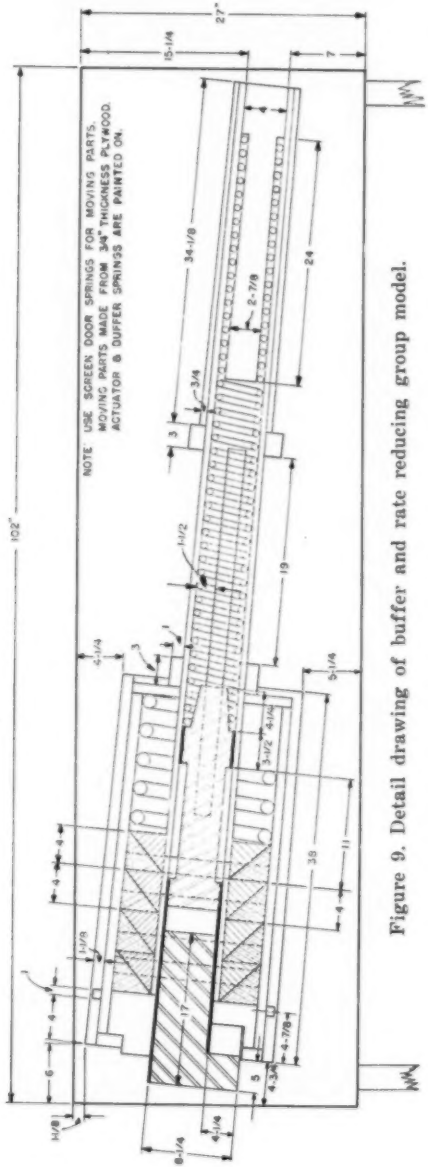


Figure 9. Detail drawing of buffer and rate reducing group model.

This action is transmitted through the three remaining sets. The model does not show the brass cups expanding against the inner wall of the buffer tube although on the weapon this actually takes place.

The discussion of the buffer portion should be conducted during a period of mechanical training devoted entirely to the buffer and rate reducing group. Action commences when the rear of the slide strikes the buffer head. The buffer head moves to the rear a short distance and strikes the first brass cup which expands over its steel cone. The movement is transmitted throughout all sets of brass cups and steel cones. To illustrate this particular step on the model the buffer head is moved sharply against the first brass cup. Since the buffer spring is painted on the model, its principle function, repositioning the four sets of brass cups and steel cones, is demonstrated manually. The instructor explains and demonstrates on the model the action taken by the buffer spring. Expansion of the brass cups against the inner wall of the buffer tube cannot be illustrated on the model.

These are the models that The Infantry School uses to teach the BAR. Their use simplifies instruction and gives the student a visible demonstration of how the weapon works. Most units can construct these models if they follow the drawings and exercise ingenuity in procuring and shaping their materials. Usefulness of the models will more than compensate for the effort involved in their manufacture.

Technique of Instruction: Critique **by Capt Marvin J. Berenzweig—the fifth in the QUARTERLY'S current series of articles on military instruction—coming in the October issue.**

Preparation for a Dawn Attack: A Problem

Maj John E. Reid, Infantry

This problem concerns actions of the platoons of heavy weapons company preparing to support the dawn attack of an infantry battalion.

Many of you probably recall instances during the last war when an attack scheduled for dawn did not actually occur until several hours later because the supporting weapons were not ready to assist the attack at the designated time.

You, as combat commanders directed to attack at dawn, are vitally concerned with all preparations made by your supporting weapons.

This problem highlights certain actions to aid both you and the heavy weapons platoons in complying with the mission of supporting a dawn attack.

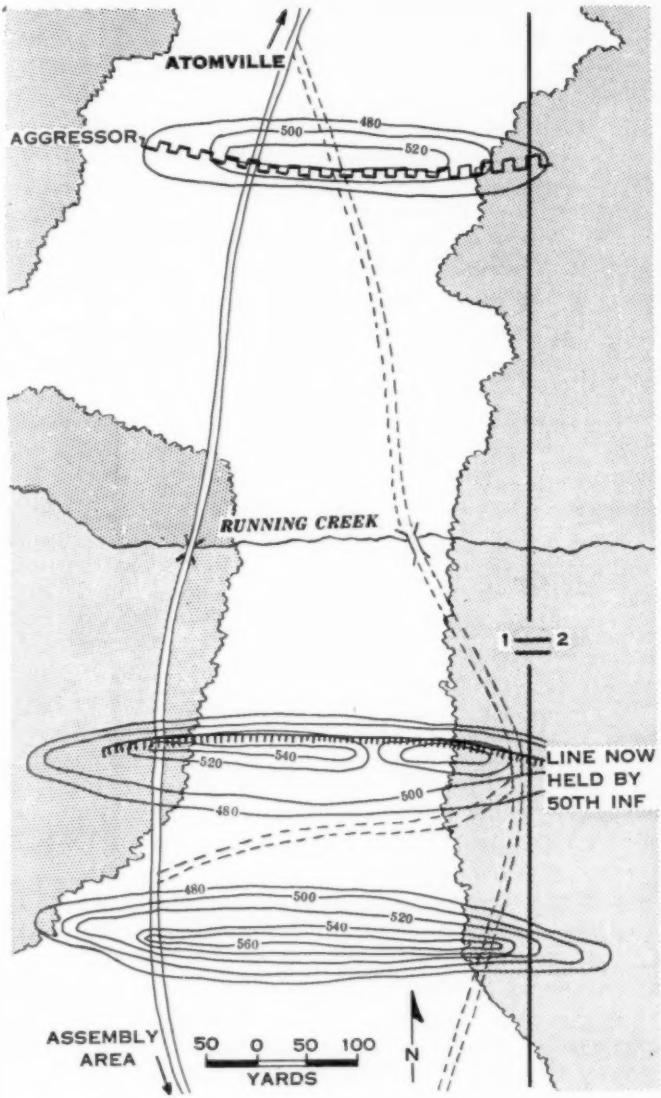
Each requirement is followed by a solution and a discussion of that solution.

THE PROBLEM

1. *General situation.* Aggressor forces have captured the mining town of ATOMVILLE, and higher headquarters have directed the 1st Infantry Division, in conjunction with the 15th Infantry Division, to regain control of this area. A part of the zone of action for the 1st Battalion, 1st Infantry, is shown on the sketch (see Map 1) that has been reproduced and made available down to include platoon leaders.

You, as *each* of the three platoon leaders of Company D, 1st Infantry, have received your map and have been able to get certain information as follows:

An estimated enemy division holds ATOMVILLE to the north.


ATOMVILLE
AGGRESSOR
480
500
520
RUNNING CREEK
1
2
540
520
500
480
LINE NOW
HELD BY
50TH INF
480
500
520
540
560
ASSEMBLY
AREA
50 0 50 100
YARDS
N

Map 1.

The 1st Infantry Division, with the 1st and 2d Infantry Regiments abreast, 1st Infantry on the right, attacks tomorrow at dawn (0615) to seize the west half of ATOMVILLE.

The 1st Infantry will move from its present rest area into an assembly area near SLAGVILLE so as to arrive there shortly after dark (1900) tonight. Permission has been given for reconnaissance parties, to include heavy weapons platoon leaders, to precede their battalions in order to contact elements of the 50th Infantry, now in positions shown on the map.

2. *Initial situation.* You are ordered to report with your reconnaissance personnel to the company commander at a designated place near the front lines. There you meet your company commander, who issues an order which includes certain questions that must be answered during your reconnaissance.

The order follows:

"You are now in the vicinity of the line of departure (present front lines held by the 50th Infantry). Enemy forces, identified as elements of the 9th Aggressor Army, have established a defensive position in ATOMVILLE. They also hold the high ground to our front.

"This battalion, in conjunction with the 2d Battalion on the right, attacks at 0615 tomorrow to capture the high ground to our front (north). Companies A and B abreast, A on the right with a frontage of 400 yards.

"Boundaries and line of departure are shown on your sketches (line of departure is represented by the present friendly front lines).

"Due to the nature of the terrain in our zone the battalion commander has directed that the 75-mm rifle platoon and the machine gun platoon be placed in direct support of Company A. Restrict your reconnaissance to the zone of Company A. Do not go forward of the present front lines nor expose yourselves to the Aggressors to the front.

"Give me your recommendations at 1600 at the junction of the road and trail (left portion of the sketch), just in rear

of the line of departure. Recommendations to cover targets, routes, and firing position areas.

"Time is now 1430."

3. *First requirement.* You are now Lieutenant, machine gun platoon. What will you do about the following:

a. Will you plan to employ all eight guns in your platoon? The four heavy machine guns? The four light machine guns?

b. How will you maintain contact with your section?

c. Who will supervise the platoon's ammunition supply?

d. Using sketch map of the line of departure (see Map 2), what numbered position area will you select for each of your sections? (Choose two.)

4. *Solution to first requirement.*

a. Plan to employ all eight machine guns.

b. Visual signals and sound-powered telephones (CE-11).

c. Platoon sergeant.

d. Numbers 3 and 6.

5. *Discussion of solution to first requirement.*

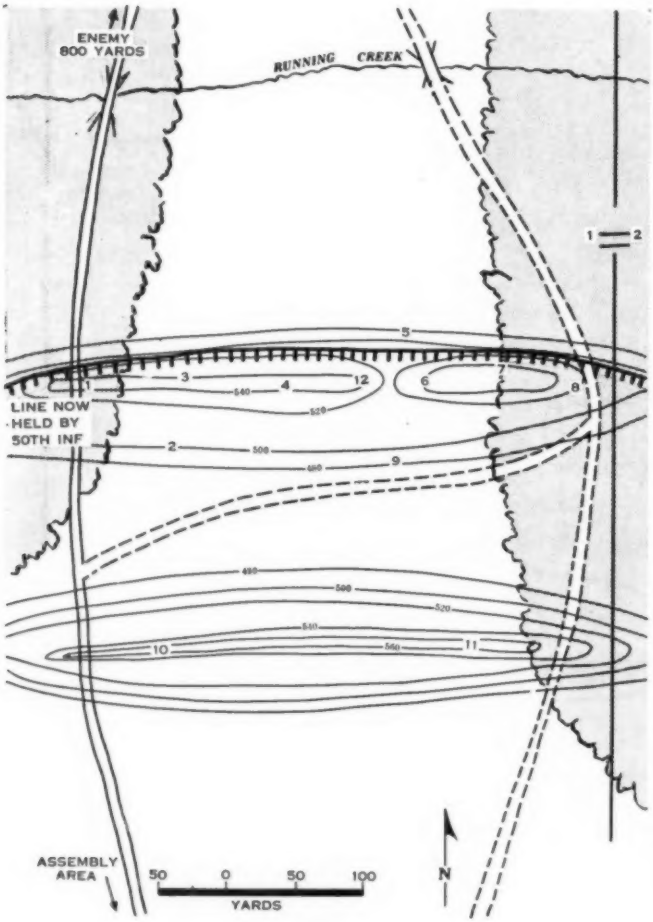
a. To give maximum support to the battalion, each squad will plan to use both its light and heavy machine guns. In this situation there is time to emplace all eight weapons, to place ammunition on each position before the attack, and to select suitable firing positions within the zone.

b. Hand and arm signals are used during all phases of the attack since positions will normally permit visual contact between the platoon leader and his section leaders. Due to the amount of time available before the attack, we also plan to install telephones, using the platoon's CE-11 sets. This platoon has only one radio (SCR-300) which is in the company command net. It can be used to transmit target information between the company commander and the machine gun platoon leader.

c. One of the principal duties of the platoon sergeant during the attack is maintaining a constant check on the resupply of ammunition. He is assisted in this mission by the transportation corporal, drivers, and ammunition bearers.

d. Numbers 3 and 6 were selected because they give observation, fields of fire, dispersion for the platoon, permit con-

trol by the platoon leader, and can be readily resupplied and evacuated.



Map 2.

6. *Second requirement.* You are now Lieutenant, 75-mm rifle platoon. What will you do about the following:

a. Against what type targets will you plan to fire your weapons?

b. How many 75-mm rifles will you plan to use to support the initial attack?

c. Referring to Figure 2, what numbered position area will you select for each of your sections?

d. How will you plan to control the fires of your platoon (by what means of communication), initially, to support the attack? To support the attack after you begin your displacement?

7. *Solution to second requirement.*

a. Crew-served weapons, grouped personnel, pillbox embrasures, and vehicles of all types.

b. Four (two rifles per section).

c. Positions 10 and 11.

d. Initially by telephone. During and after displacement, by radio (SCR-536).

8. *Discussion of solution to second requirement.*

a. Due to the weight of each round of 75-mm rifle ammunition (approximately 25 pounds) and the difficulty of maintaining ammunition resupply, the platoon will not fire during the preparation before H-hour unless point targets, such as crew-served weapons, pillbox embrasures or grouped personnel, have been definitely located. If none of these targets are available the 75-mm rifles will occupy positions and be ready after H-hour to fire on surprise targets such as those listed above, plus vehicles of all types. The accuracy and large caliber of this weapon make it particularly valuable against surprise targets which appear after H-hour. In contrast to defense situations in which the 75-mm rifle is given a primary mission of firing against enemy tanks, in attack an antitank mission is considered secondary. Attached tanks will be available for the antitank mission and the other listed targets for the 75's are more important.

b. You will plan to use two 75-mm rifles per section to support the initial attack. As was the case with the machine gun platoon, there is sufficient time to occupy the positions

selected, place ammunition by each weapon before the attack, and find positions in which to place the platoon's four rifles. Once displacement begins, we'll put one rifle per section on the carrier and use only two rifles out of the platoon. This is normal during displacement unless conditions permit finding positions for the additional weapons and time to supply and occupy those positions.

c. Positions 10 and 11 are the best available within the zone. They permit observation and fields of fire across the front of Company A, adequate dispersion for the platoon, and resupply of each rifle. The positions selected are near covered and concealed routes which permit displacement to new firing positions. In addition, the positions are located on the first terrain feature in rear of the line of departure. This keeps enemy counterfire, intended for the 75's, away from friendly troops on and near the line of departure.

d. The platoon has, in addition to its SCR-300 in the company command net, three SCR-536's and five CE-11 telephones. Initially, in the attack, when time permits the employment of all four 75's, the platoon leader plans to install telephone lines with one CE-11 at each rifle position and one with himself. After displacement begins and the speed of the attack permits the use of only one rifle per section, he relies on the SCR-536's for fire control with one radio with each rifle and one with himself. Visual and messenger communication will, of course, be used during all phases of the attack, conditions permitting.

9. *Third requirement.* You are now the 81-mm mortar platoon leader. What will you do about the following:

a. Will you plan to employ your platoon in one platoon firing position or two section firing positions?

b. Where will you put the platoon fire direction center?

c. How will you provide for forward observation for your platoon?

d. Where will you be during the attack?

e. To have your platoon ready to accomplish its mission at dawn tomorrow, when will you move the platoon into firing position and how will you get needed fire data?

10. *Solution to third requirement.*

a. Platoon firing position.

b. In or near the platoon firing position area.

c. By sending a forward observer (section leader) with each of the leading rifle companies and establishing a platoon observation post.

d. Where you can best control the fires of your platoon (see discussion).

e. (1) If possible, move in before darkness and register. (2) Move in before dawn and trade base plates and get target information from a 50th Infantry mortar platoon already in position. (3) Move in before dawn and register after H-hour.

11. *Discussion of solution to third requirement.*

a. Wherever possible, the 81-mm mortar platoon occupies a platoon firing position area to reduce the problem of control and ammunition supply and to increase the platoon's ability to mass its fires quickly on any target within the battalion zone. Section firing positions are occupied when: (a) the battalion zone is too wide to permit coverage from a platoon position; (b) when a part of the battalion is operating away from the rest of the battalion and out of supporting distance of a platoon firing position. In the latter case one section may be attached to the element operating alone.

b. The platoon fire direction center is located in or near the platoon firing position area to facilitate transmission of fire orders between the two. This location allows the platoon sergeant, who normally operates the fire direction center, to exercise a certain amount of control over the bulk of the platoon which is located at the firing position. It also permits the platoon sergeant to supervise more closely the expenditure and resupply of ammunition.

c. Forward observation under this situation, when the platoon is in general support of the battalion, can best be obtained by sending a forward observer (section leader) with each of the leading rifle companies. These observers are in direct communication with the fire direction center through the SCR-300 platoon fire control net and transmit

requests for fire on targets either selected by themselves or indicated by the rifle company personnel. If the platoon leader wishes to supplement this coverage, he may establish a platoon observation post which he, personally, may occupy or have manned by personnel of his platoon.

d. You as platoon leader, go where you can best control the fires of your platoon. This may be in one of many positions. It may be with one of the forward observers in whose area the need for mortar fire is greatest; it may be at a platoon observation post covering all or part of the battalion zone; or it may be at the platoon firing position, supervising the actual firing of the mortars. Under certain other conditions, you may be with the heavy weapons company commander or even the battalion commander. The platoon leader is not normally restricted to any one of these locations, but moves about freely, controlling and supervising his platoon and their activities.

e. During daylight is the best time for the 81-mm mortar platoon to move into its firing position. Since mortar positions are usually defiladed from enemy view, they can be occupied in daylight. In this case the weapons may register before dark. In the situation that faces us today we know that our platoon is not scheduled to reach the assembly area until after dark. Therefore, we must resort to going into our firing positions in darkness. We might find an 81-mm mortar platoon from the 50th Infantry already in position. If so, we can arrange to exchange base plates and also get from them necessary range and target information. If unable to exchange base plates, we must occupy a position and be prepared to register as quickly as possible after H-hour (dawn) as targets become visible.

12. *Situation, continued.*

The reconnaissance details completed their recommendations and submitted them to Captain Company D, who consolidated them and gave his recommendations to the battalion commander. A short time later the battalion commander issued his operation order for the attack. It indicated approval of the recommendations as submitted by the platoon leaders.

The battalion has closed into the assembly area, non-organic vehicles have been released, combat loads of rations and ammunition have been issued, all last minute checks and preparations have been completed, and the heavy weapons platoons are now ready to begin their movement from the assembly area to the positions selected by the platoon leaders on the previous day.

13. *Fourth requirement.* You represent each of the platoons of the heavy weapons company.

a. Should your battalion commander order your platoons to move out of the assembly area before or after the rifle companies?

b. Will the 75-mm rifles fire on the enemy positions before H-hour?

c. Will the 81-mm mortar platoon place any ammunition on the ground near the guns or will all of it be kept on the carriers?

d. Who is responsible for planning the displacement of each of the three platoons and when will this displacement take place?

14. *Solution to fourth requirement.*

a. Before the rifle companies.

b. The 75-mm rifles will not fire a preparation before H-hour.

c. Only that amount required to fire preplanned fires will be placed on position.

d. Each platoon leader is always concerned with displacement and whenever possible prepares his plans even before the attack commences. The displacement begins when the fires are masked by friendly units or when the mission cannot be accomplished without displacing to new positions.

15. *Discussion of solution to fourth requirement.*

a. Platoons of the heavy weapons company leave the assembly area before the rifle companies, since some of their movement will be by foot and, therefore, no faster than the movement of riflemen. Heavy weapons personnel must place their weapons in position, requiring a certain amount of hand-carry, and must supply them with ammunition. All

of this takes more time than will be needed by the riflemen to move from the assembly area, complete last minute coordinations in the attack position and actually start their attack, which to be successful must be supported by the heavy weapons.

b. The 75-mm rifles will not fire unless their targets have been definitely located. In this case the absence of visibility before dawn means that those targets that may have been selected by the platoon leader the previous day could have been moved during the night. These rifles will not be fired until after dawn (H-hour) when targets can be definitely located.

c. Normally the 81-mm mortar platoon maintains its ammunition on the platoon's carriers, putting only those rounds on the ground that will be required for planned fires. If it is known that so many rounds will be fired on certain targets during the early stages of the attack, then that number of rounds will be taken from the carriers and placed near the weapons. The loads of the carriers are then consolidated and empty carriers sent to the rear to reestablish their basic loads.

d. Each platoon leader begins thinking of displacement plans as soon as he starts planning for the attack. To accomplish his mission of close and continuous support, displacement must be prompt and timely. A part of the command begins displacement as soon as it appears that fires are about to be masked by friendly riflemen or whenever it appears that the mission cannot be accomplished from present positions.

SUMMARY

To support an attack at daylight by an infantry battalion, the platoons of a heavy weapons company often use techniques that differ from those utilized in either a normal day attack or an attack made during darkness.

The most important techniques indicated by this problem are:

The machine gun platoon leader makes every effort to use the concealment of darkness to place all eight of his

machine guns in position to support the initial attack. He selects position areas to enable his platoon to fire on targets that might be occupied by Aggressor just before dawn.

The leader of the 75-mm rifle platoon normally plans to use all four of his 75's so that they can fire on such targets as crew-served weapons that may be moved in by Aggressor during the night. In both of these platoons we find maximum and aggressive use of carriers. The off-carrier positions will be just in rear of the weapons' position areas, taking advantage of darkness to reduce the amount of hand-carry of ammunition and weapons.

Whenever conditions permit, the 81-mm mortars move into firing positions before darkness and register. If registration would indicate a forthcoming attack or if the platoon cannot occupy the selected position before dark, the platoon leader tries to exchange base plates and obtain information from a mortar unit already in contact. As a last resort the platoon moves into position just before dawn and registers immediately after H-hour.

Generally we find that more time is available (and required) to prepare for this type of attack than for a normal daylight attack. This additional time is needed for more complete reconnaissance, preparation of fire data, and for occupation of positions during a period when control is handicapped by a rigid requirement for noise and blackout discipline and when last minute coordination is very important.

The advantages to a unit called upon to launch a dawn attack will be many; however, they will be the result of full cooperation, coordination and diligent effort on the part of the attacking force.

Communication Data Rule

Capt C. A. Martin, Jr., Infantry

Figure 1. The Infantry School's Communication Data Rule is as useful in the field as in the classroom.

A memory aid is needed for both those teaching and learning signal communication in infantry units. Such an aid is also useful for those whose duties occasionally require them to use signal communication data such as details of equipment, personnel, and communication nets.

One way to reduce the amount of memory work is to consolidate essential information in some handy, visible form that can be carried by the individual user.

The Infantry School's solution to the problem is the "Infantry Communication Data Rule." This is a cardboard, or

plastic, device made up along the same lines as a circular slide rule. (See Figure 2.) It incorporates the most needed information on infantry communication equipment and personnel. It is a concentrate of the information that is carried in far greater detail in communication texts, pamphlets, and mimeographed material.

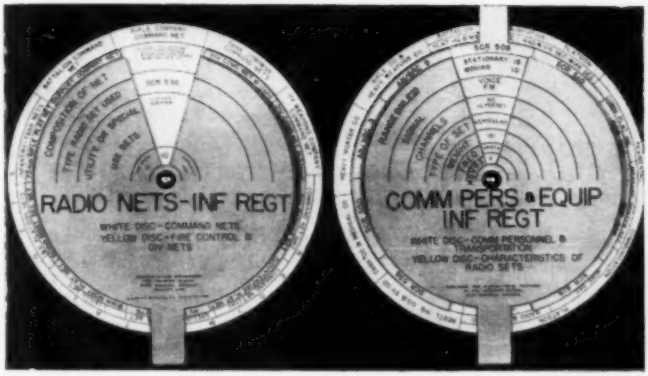


Figure 2. The two sides of the Communication Data Rule incorporate the most needed information on infantry communication equipment and personnel.

From one side of the data rule you can extract the following information:

1. The communication personnel and their transportation for every company and headquarters in the infantry regiment.

2. Characteristics of all radio sets in the regiment. These characteristics include:

a. Range in miles.

b. Type of signal (voice, continuous wave (CW), or modulated continuous wave (MCW); and type of modulation, AM (amplitude modulated), or FM (frequency modulated).

c. Number of channels (preset and continuous tuning).

d. Type of set (vehicular or manpacked).

e. Weight.
f. Frequency range.
g. Number of receivers per set.

The other side of the rule shows all the radio nets in the regiment. They include:

1. Regimental nets.
   a. AM command net.
   b. FM command net.
   c. Special purpose net.
   d. Liaison net.
   e. I&R Platoon nets.
   f. Infantry-tank nets.
2. Battalion command net.
3. Rifle company command nets.
4. Tank company command nets.
5. Heavy weapons company command and fire control nets.

The same side shows:

1. Units in each net.
2. Type radio set used.
3. Utility or special use sets in each net.
4. Number of stations in each net.

All this information is printed in "pie-slice" sections on cardboard discs that pivot around a common center. (See Figure 2.) This, the Communication Data Rule, is small enough to be carried easily in shirt or jacket pocket.

The Infantry School has manufactured a limited supply of these Data Rules.* However, construction is so simple that local reproduction is quite possible.

Figure 3 shows the two sides of the inner disc with its dimensions. One side, indicated as "Side 1," shows the personnel and transportation in the communication units of the regiment and its battalions and companies. Side 2 shows the radio nets in the regiment and its units.

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*Communication Data Rules are on sale through: The Book Department, The Infantry School, Fort Benning, Georgia. Price: 10 cents each.

Figure 4 shows the next set of discs, which fit over the inner disc, This set has wedge shaped cutouts through which data on the inner disc may be read. The connecting strip between the two halves of this set of discs serves as a tab for turning the set after assembly.

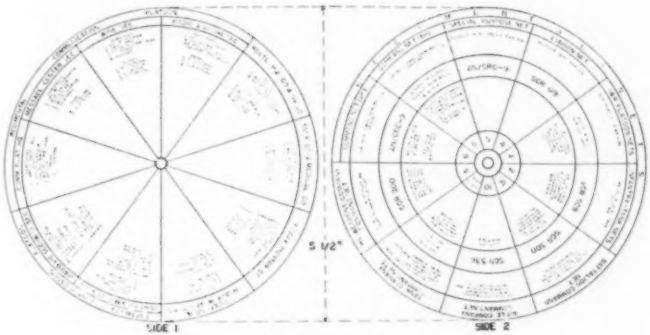

Figure 3. The two sides of the inner disc.

Side 1 shows the characteristics of the various radio sets; Side 2 shows division command and warning nets and more of the nets in the regiment.

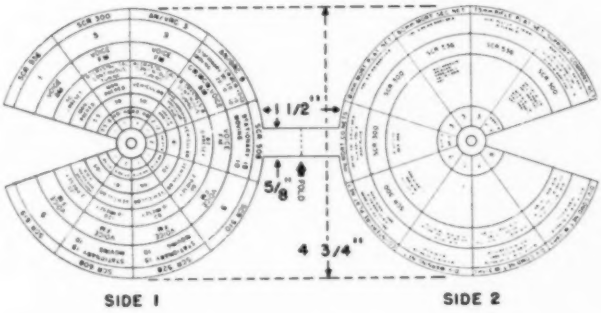

Figure 4. Middle set of discs.

The outer set of discs is shown in Figure 5. This is the selector set. Its two sides list the *types* of information desired.

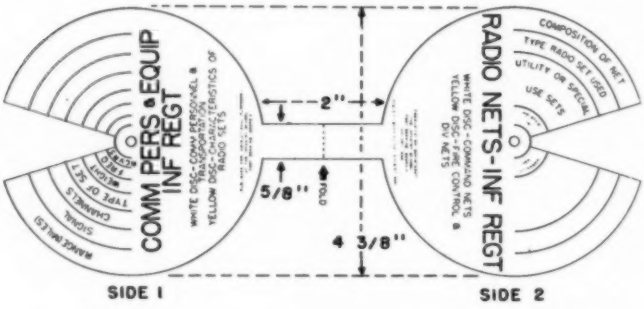

Figure 5. Outer set of discs.

Dimensions are indicated on the drawings. The discs are printed on rectangular sheets of paper, cardboard, or plastic from which they may be cut out and assembled by the user.

The Data Rule is designed to be equally applicable to classroom or field use. Here is the kind of field problem on which the Rule comes in handy:

The I&R Platoon is to be employed forward of its regiment during an approach march. The regimental S-2 wants to know:

1. What radio communication will be possible between the I&R Platoon and the regimental march command post.
2. How he, the S-2, may communicate directly with the I&R Platoon.
3. What is the maximum range over which the regimental march command post can maintain voice and CW radio communication with the I&R platoon.

Here's how you use the Communication Data Rule to find the answer:

1. Use the side labeled "RADIO NETS-INF REGT." Line up the "reading wedges" of the two outer discs so

that information may be read through them on the large center disc. Note that under the heading "Regimental Command Net" both the I&R Platoon and the regimental CP are in both the AM net and the FM net.

2. In the AM net both stations use the AN/GRC-9 radio. In the FM net the I&R Platoon uses the SCR-619; the regimental CP uses an SCR-608; and the S-2 has a set, the SCR-619.

3. With Questions 1 and 2 answered we turn to the other side of the Data Rule to determine the characteristics of the equipment. The "reading wedge" of the smallest (the outer) disc is aligned with the heading "AN/GRC-9" on the medium-sized disc. From this setting we find the AN/GRC-9 when stationary has a range of 30 miles on CW (continuous wave); 20 miles on MCW (modulated continuous wave); and 15 miles for voice. If the vehicle on which the set is mounted is moving, the ranges decrease to the following: CW, 20 miles; MCW, 10 miles; and voice, 10 miles.

Similar alignment under the heading "SCR-619" shows that set's range as 5 miles. A check under "SCR-608" shows a stationary range of 15 miles and a range of 10 miles when in motion.

Thus the Data Rule has shown us what nets the stations, in which we are interested, operate; what radio sets are used in each net; and what ranges we can expect from these sets.

A knowledge of all the facts contained on the "Data Rule" will not, in itself, qualify an individual as an authority on infantry communication. This is still accomplished only by hard work and continuing conscientious effort on the part of the trainer and trainee alike. The Rule does, however, reduce the memory work required of the communication man and permits him to concentrate more on the accomplishment of his mission of maintaining continuous communication.

Technique of Instruction: Examination*

Capt Marvin J. Berenzweig, Infantry

When a troop leader uses the examination stage of instruction, his main concern is to find out whether or not his men understand the subject and can apply their knowledge. For example, the platoon leader winds-up rifle marksmanship instruction by firing his men for record. He uses the results to discover what they really have learned, to check their understanding of rifle marksmanship and their ability to apply their knowledge in action. He may uncover weaknesses or gaps in their knowledge of rifle marksmanship—weaknesses that may be due to the learning ability of the men, the instructional methods, or both. Primarily he checks their learning to see how well his men understand their jobs and how he can improve his instruction to better prepare them for combat—the ultimate objective of all training.

Like preparation, presentation, and application, examination is an integral part of the instruction process. It's the instructor's means of checking how much learning has taken place. It's the instructor's means of determining if the essentials covered in a particular lesson have been impressed on the soldier's mind.

According to their form, there are three general types of examinations or tests—oral, written, and performance. The oral test is used by instructors in almost every lesson they teach. It is easy to prepare and involves very little paper work. The instructor prepares a list of specific questions and during the instruction calls on one soldier at a time for the various answers. However, this takes

*This is the fourth of a series of short articles on the TECHNIQUE OF INSTRUCTION.

class time; it is not suitable for thoroughly checking the learning of a large group of men.

Written or "pencil and paper" tests, in which the men write answers or solutions to questions or requirements, fall into two categories—the essay and the objective type. In the essay test broad questions or statements are followed by directions to discuss or explain the problem. The test is designed to make the soldier recall and logically express in writing all that he knows about the subject of each test item. Its greatest advantage is that it encourages independent thought, but its practical disadvantages are many. The time required for adequate coverage and scoring is usually excessive and—more important—men who are good writers may "bluff" convincingly, while those without the knack are penalized. Generally, essay tests are not recommended for ordinary troop training.

Objective tests, on the other hand, are more practical for the troop leader and his men. The leader quickly can check the progress of his instruction by giving his men a spot quiz of five or ten objective type test items. He can see at a glance whether the answers are right or wrong—a feature that greatly reduces error on the instructor's part. Because the men are not required to do a lot of writing, and because the test items can range from factual questions to the thought-provoking kind that require reasoning, the objective test has distinct advantages. But it too has disadvantages unless prepared with great care by an instructor who knows the errors to avoid. Let us look at some poor examples of the objective-type test and discuss the errors individually.

EXAMPLE I

(True-False Type)

1. Complete reliance cannot be placed upon any one means of communication. T..... F.....
2. Whenever practicable, a night march is made along routes that have been previously reconnoitered. T..... F.....
3. To locate the North Star at night, look out for a distance roughly equal to five times the distance between the pointers in line with the pointers in the direction in which the water would flow from the Dipper. T..... F.....

4. The T/O infantry regiment includes three battalions, each commanded by a major. T..... F.....
5. The infantry regiment is *not* without organic means of counteracting mechanized attacks when other divisional antimechanized forces are not available or have not been attached. T..... F.....

It is not difficult to criticize the above items. In the first one, the word "complete" indicates an obvious answer, as does the negative—"cannot"—tip off that the answer is false. In the second, the first two words weaken the challenge by indicating a true answer. In the third, too many words confuse the thought. The fourth item contains a half-true, half-false statement; it smacks of a "curve-ball" or "catch" question. The repeated negatives of the fifth item confuse the intent. All of these are poor test items because they either cloud the issue or are far too obvious. How would you like to answer the fifth one yourself? You wouldn't? Well, neither would your men. But you could answer the first statement with hardly any thought at all. Sure—and so could your men. These test items run the gamut from ridiculous ease to unnecessary difficulty—difficulty caused not by the inherent question but by the *way* it is stated. Let's rework those items into *good examples;* note the picture technique used to clarify question 3.

1. A battalion commander relies on more than one means of communication. T....X.... F.....
2. During a night march routes that have been previously reconnoitered by your troops should be avoided. T..... F....X.....

---

3. Sketch of the Big Dipper and the North Star

To locate the North Star at night look for the Big Dipper and you will find the North Star at the point indicated by the arrow in the above sketch. T..... F....X.....

4. *a.* The T/O infantry regiment includes three battalions. T....X.... F.....

b. The T/O infantry regiment is commanded by a lieutenant colonel. T..... F....X.....

5. The infantry regiment has organic means of counteracting mechanized attacks. T....X.... F.....

EXAMPLE II
(Completion Type)

1. Leadership is based on .....
.....
.....

2. The caliber .30 machixe gun is a .....
.....
.....

3. A prisoner of war is required to tell only his name, ...
....., and serial number.

Let's tear these apart. The first is too broad a subject for the brief answer indicated by the spaces. The second one could be answered in ways not intended; a man might very correctly answer, "the .30 caliber machine gun is a *damn good* weapon." Who could deny the accuracy of this? But it wasn't what was intended, was it? And the third item is too easy for most classes; it presents no challenge to knowledge. Without listing some good examples of the completion-type test, the reader can see, from this brief criticism of it, the main errors to avoid.

EXAMPLE III
(Multiple Choice Type)

1. In testing water after it has been purified by chlorination, which of the following *colors* indicates that chlorine has been used?
   A. Deep magenta.
   B. Faint heliotrope.
   C. Strong aquamarine.
   D. Well-marked yellow.
2. The model 1937 field range should be operated with a:
   A. Green flame.
   B. Smoky flame.
   C. Orange flame.
   D. Supply of red gasoline.

To criticize these two multiple choice type examples we can use one word—inconsistency. For example, the second item of the first question, faint heliotrope, is both an odor

and a color. For that matter, it is also a plant. The second question is likewise guilty of inconsistency—the choices include two entirely different categories—flames and fuels. There is irrelevancy here. If you are giving a man an examination on *how to read a map*, a question about how maps are reproduced would be irrelevant to the purpose of the test.

In brief, then, objective-type examinations as all other types should be relevant to the subject, comprehensive, reliable, easy to take, easy to score, and fair. Together with their advantages and disadvantages they have their place in the instruction process, but only when used to *supplement the performance test.*

With that thought in mind, let us proceed to the performance test which is the most direct method of measuring the ability of an individual or a unit to do a job—and the effectiveness of the instruction. It should be used more than the oral and written kind combined. For training men for combat it is the best test. It gives the answer to the question, "can he do it?" It answers with sometimes embarrassing directness the question, "can my platoon do it?" To find out if a gunner can reduce a stoppage in a machine gun, the best test is to set up a stoppage and have him reduce it. To determine a squad's combat effectiveness, the best test is to put it through a practical firing exercise under simulated combat conditions. (Below is a sample training test, including an umpire score sheet, for a rifle squad in attack. It also illustrates a good *form* to use for writing small unit exercises. It is not complete without a critique.)

TRAINING TEST FOR RIFLE SQUAD IN ATTACK

PART I

General

1. *General.* The test applies to all squads armed with the M1 Rifle as the basic weapon. This includes infantry, airborne infantry, armored infantry, and combat engineer squads.

2. *Purpose.* To determine the degree of proficiency of the rifle squad in attack under simulated combat conditions.

3. *Scope of Test.* The test consists of an attack in which the rifle squad captures a defended hostile position, then reorganizes.

4. *Administrative Details.*

a. Troops: One rifle squad, combat equipped.

b. Uniform: As required by the situation. The chief umpire acts as the rifle platoon leader.

c. Targets: Type E or F silhouettes. The targets are concealed and partially concealed. They are distributed to represent normal enemy dispositions.

d. Ammunition:

Each rifleman: full belt (80 rds) plus two bandoleers (96 rds).

AR man: full belt (240 rds).

Ass't AR man: 200 rds for AR plus 48 rds in his belt for his own rifle.

5. *Scoring.*

a. The attack is scored under six phases of performance (para 8, Umpire Score Sheet, Problem Phases a-f.) Each umpire has a score sheet and grades all or a portion of the action under each of the phases. In cases where more than one umpire grades the same phase, the average is taken as the final score.

b. The effect of fire (phases *d* and *e*) is based on the umpire's observation of the effectiveness of fire distribution on the enemy position and on the number of hits made on the targets.

c. The maximum score for the squad is 100 points; the minimum passing score is 60 points.

6. *Time.* Two hours is allowed to complete the test for one squad. This includes a 15 minute critique at the completion of the exercise.

PART II

FIELD EXERCISE
RIFLE SQUAD IN ATTACK

7. *a.* GENERAL SITUATION. The rifle company is in its assembly area preparatory to a daylight attack. Having gone forward and received the company attack order, the platoon leader is now at an observation post where a messenger has guided the squad leader to be oriented and to receive the platoon attack order.

b. INITIAL SITUATION. The squad leader upon joining the platoon leader at the observation post receives the attack order: (the actual order is deleted in this illustration only).

FIRST REQUIREMENT. Action and orders of the squad leader upon receiving the attack order.

c. SECOND SITUATION. (Concurrent with the initial situation.) The squad, less the squad leader, is in its assembly area.

SECOND REQUIREMENT. Actions of the assistant squad leader and individual members of the squad in the assembly area.

d. THIRD SITUATION. The squad leader completes his reconnaissance and issues his attack order. At H-hour, the attack begins and the squad advances approximately 200 yards forward of its line of departure where the leading elements of the squad receive enemy fire from a location approximately 300 yards to the front. (Targets indicating enemy appear on the objective; firing of blanks from pit indicates enemy fire superiority.)

THIRD REQUIREMENT. Actions and orders of the squad leader and individual members of the squad.

e. FOURTH SITUATION. The squad gains fire superiority —(indicated by intermittent firing of blanks from pit).

FOURTH REQUIREMENT. Actions and orders of the squad leader and actions of the squad.

f. FIFTH SITUATION. Advancing by fire and movement, the squad reaches the assault position where it deploys as skirmishers (if not already in that formation) and on order of the platoon leader, begins the assault on the objective.

FIFTH REQUIREMENT. Actions and orders of the squad leader and of the squad in the assault.

g. SIXTH SITUATION. The squad, using assault fire, seizes its part of the objective, and then reorganizes.

SIXTH REQUIREMENT. Actions and orders of the squad leader and of the squad in the reorganization.

8. *UMPIRE SCORE SHEET*

Unit Tested .....

Place ..... Time ..... Date .....

	Weight	*Score*
a. Action in Assembly Area:	5	.....
Dispersion of individuals		
Supplying Ammunition and food		
Marking and stacking excess equipment		
Supervision exercised by assistant squad leader		
b. Action of Squad Leader Prior to Attack:	15	.....
Understanding of and notes on platoon attack order		
Reconnaissance (plan and execution)		
Decision and plan of attack		
Clarity, brevity, and completeness of order (includes terrain orientation either on ground, on map, or on map substitute)		

c. Initial Actions in Attack:	10	.....
Cross LOFD on time		
Initial formation (positions of individuals, control by leader)		
Use of covered route		
d. Actions When Fired Upon:	30	.....
By lead men		
By squad leader and assistant squad leader		
Use of AR Team		
Fire control		
Gaining fire superiority		
Use of fire and maneuver to gain assault position		
e. Actions in Assault:	25	.....
Formation for assault		
Positions of leaders		
Assault fire		
Movement to far edge of objective		
f. Actions in Reorganization:	15	.....
Preparation to meet a counterattack		
Preparation to continue the attack		
	.....	.....
TOTAL	100	..... points

TOTAL SCORE: ..... points

(Minimum passing score is 60 points scored as follows:

1. At least 10 points must be scored on phase b, above.
2. At least 30 points must be scored on phase d and phase e combined.
3. At least 20 of the 30 remaining points must be scored on phases a, c, and f combined.)

As you may conclude from reading the above tactical exercise, all performance tests involve detailed preparation. Adequate time, personnel, facilities, and equipment are required. To coordinate details and to insure that the test is practical, the test must be rehearsed in detail. However, it is worth the trouble. You can find out best whether or not your men understand the instruction and can apply their learning when you put them to the *DOING* test.

"You're Now S-2 . . . "

Lt Col Raymond E. Daehler, Infantry

When Major Able reported to his new regiment, Colonel Blunt lost no time in orienting him.

"Ever been an S-2, Able?"

"No, sir."

"Know anything about intelligence?"

"Combat experience, sir and a recent and thorough indoctrination on the subject at The Infantry School."

"Fine. You're now S-2 of this regiment. My views on intelligence don't differ with what The School teaches. Nevertheless, I'm going to give you my views. If much of what I say is already known to you, mark it down to the importance with which I regard intelligence training and the production of intelligence in combat.

"Able, I want this regiment intelligence conscious. This will be done by intelligence training, the purpose of which is to have every officer and enlisted man efficient in intelligence duties.

"In this regiment, as in any other, intelligence specialist training will include instruction in the collection, recording, evaluation, and interpretation of enemy information and the terrain; in dissemination and use of military intelligence; in direction of the collection effort; and in counterintelligence. This training will not be restricted to the intelligence sections of this regiment; consistent with their primary duties, intelligence subjects will be given every member of the command, as it's my view that everyone has a part to play in military intelligence. Men assigned to T/O intelligence duties will receive additional and more thorough instruction.

"The responsibility for this training is mine; you will plan and supervise it for me. I think you'll find that if your own intelligence section thoroughly understands the practical application of intelligence techniques and theories, and if it has a spirit of cooperation, then you'll have a foundation for efficient intelligence work throughout the regiment. You'll gain not only the respect of the lower intelligence agencies, but also give them a desire to acquire and furnish you with all possible enemy information. Good work begins at the top and filters down.

"It may be theoretically possible to run your job from a desk, but I have never seen it work in practice. Get out and visit. Get out and supervise. Get out and help your intelligence people find the training aids and equipment they need. See to it that your instructors know their jobs.

"You'll work closely with S-3, whom I charge with staff responsibility for all training. Tell him how much time you want for intelligence training. Tell him your requirements for facilities, training aids, and instructors; work out the details in collaboration with each other. Your close relationship with him does not cease upon formal publication of the training program. When you fully understand his entire program, you can effect much intelligence training that is not specifically called for in that program. It is a matter for imagination and ingenuity on your part. You can, for instance:

> Prepare and submit route sketches for road marches.
> Submit messages concerning the "enemy" during squad, platoon, and other combat exercises.
> Prepare terrain studies for S-3 to assist him in his preparation of terrain exercises.
> Act as the "enemy" in field exercises and report on what was observed.

"Cooperation of this type, Able, will make a successful S-3 into a good intelligence officer; conversely, it will make a successful intelligence officer into a good S-3.

"I want all intelligence training to be thorough. In the case of men whose primary duty is intelligence, I want it

comprehensive. The program for these men will include, but is not limited to, a study of:

The nature and sources of information.
Examination of documents, material, and prisoners of war. In peace, these prisoners will be Aggressor. See that your men know all about him.
The theory and practice of observation.
Military sketching, map reading, and air photo reading. These I regard as extremely important; your men and officers must know them, or they are valueless.

"Intelligence officers of this regiment and selected enlisted men of the intelligence sections will be trained in:

Evaluation of information.
Interpretation of information.
Estimate of the enemy situation.
Determination of enemy capabilities.
Dissemination of information and intelligence.

"This is by no means the complete list of subjects, as you will immediately recognize. There is considerably more. Further, I shall expect your own ideas after you have thought them out in discussion with S-3.

"Now is a good time to tell you what I shall expect at the end of the training program. At that time I want every man whose main duty is intelligence to be a specialist in his work. I want a considerable number of men whose main duty is not intelligence to be capable of becoming specialists after an accelerated course. And I want the entire regiment intelligence conscious. Achieve the first two, and the third is easy.

"Organizations and selected personnel of this regiment that require specialist training are:

Regimental I & R Platoon.
Battalion intelligence sections.
Selected tank company men.
Counterfire Platoon.
Selected shelling report personnel.
Attached intelligence personnel.

"The men in these units and the selected personnel will become your specialists. You'll spend more time with them, more effort, more thought—because intelligence and information is their main job. But—do not lose sight of the individual soldier in the companies. Each man in this command is a potential producer of information, and I want him to know information when he sees it. To see it—or to hear it—he must know what it is all about. You and your instructors are there to tell him. You'll have the opportunity to do so.

"You are going to have a lot to say about the type of men to be assigned to the intelligence agencies of this regiment. I have instructed S-1 and the Personnel Officer to cooperate with and assist you in their selection. You want officers and men who have a good military background—people with a sound general knowledge of the army. Your enlisted men should have good physique, good judgment, observant minds, and so forth. If at all possible, you'll get them. Definitely you'll not get a soldier until he has completed basic training. Definitely all your men—your future specialists—will have the equivalent of a high school education. I don't expect you to work without proper tools.

"A word about your intelligence officers. Again you'll have much to say in their selection. Among their qualifications I list these as mandatory, and there are other points equally important:

A thorough knowledge of the capabilities and limitations of intelligence agencies in higher, lower, and adjacent units.
A thorough knowledge of tactical doctrines, organization, and equipment of our own and enemy forces.
The energy and tact required to work closely and constantly with intelligence officers of higher, lower, and adjacent units.
The capacity to appreciate the relative importance of the various items of available information.

"In this regiment your intelligence officers will not be assigned a multitude of 'additional duties.' The policy here

is to confine these duties to officers concerned mainly with administrative matters.

"I have told you bluntly what I expect you to accomplish by the end of the training program. I am not going to tell you *how* to do it except in the broadest sense. The methods of training are set out in FM 21-5, and TM 21-50, Army Instruction, and are applicable to intelligence training. I like the principles of preparation, presentation, application, examination, and discussion. Get ready. Tell them. Show them. Have them do it. Then discuss it.

"I believe the specialized intelligence training should be centralized. This has the advantage of standardizing instruction, getting the most efficient use from the instructors, and economizing on training facilities. Throughout all your training I'd like you to stress the concept of Aggressor, the maneuver enemy. The use of Aggressor forces in maneuvers permits realistic training in every aspect of combat intelligence.

"I said at the beginning of our discussion that I want the regiment intelligence conscious. I repeat it now. How you do it depends on your initiative and imagination. Never let a chance go by in all field exercises and maneuvers to include intelligence training. The way you do it is up to you, your imagination, and originality. If you do it well—and your record tells me that you will—I can tell it by talking to any private. If done poorly, it will be obvious throughout the regiment....Now, Able, you've had my views on intelligence. In a few days, when you're squared away, I'll expect yours. Between the two of us we'll satisfy the division commander and his G-2."

9,000 Students by Mail **by Capt George R. Adjemian—how The Infantry School furthers their training and helps 9,000 infantrymen earn credits toward promotion and retirement through its Army Extension Course Department—coming in the October QUARTERLY.**

Guns Against Armor*

Lt Robert N. Ives, Infantry

*Editor's Note: The subject matter of this article is not specifically taught at The Infantry School. The article is published for its interest to infantrymen, especially tankers.

In 1914 the great war of attrition had rooted itself in the mud and slime of the trenches. "No Man's Land" became a quagmire of death. Neither the Kaiser nor the Allies could make a dent in the firmly established lines of the other's trenches. Men went "over the top" time after time to be cut down by the other's machine guns. The immense stalemate seemed to have no end.

Colonel Ernest Swinton, an officer in the British Army, conceived an idea. He was convinced that a track laying vehicle, protected by iron plates, could advance over No Man's Land and over the opposing trenches and guns to break the impasse. He presented his idea to the British War Office and was refused and even ridiculed. Undiscouraged he went to the British Admiralty** which accepted his idea and promoted the building of these vehicles. Over 100 full track laying vehicles were constructed and shipped to the battle

**Editor's Note: The fact that the British Admiralty and not the War Office accepted and developed Colonel Swinton's idea was due primarily to Mr. Winston Churchill, then First Lord of the Admiralty. Of all the members of the Committee of Imperial Defense to which Colonel Swinton presented his idea, Mr. Churchill alone appreciated its vast possibilities. He continued Colonel Swinton's fight through other established ministries with only meager success; the War Office did experiment briefly with two Holt tractors but shortly thereafter pigeon-holed the idea completely. So Mr. Churchill formed his own committee within the Royal Navy which he called the "Landship Committee." This group, under the chairmanship of Sir Tennyson d'Eyncourt, followed the idea through to the actual employment of the tanks. Even today, this naval origin is apparent in such terms as "*hatch, ports, hull,* and *deck*" which identify portions of the tank.

zone under great secrecy. It was during this great secrecy that the name "tank" was born. For all intents and purposes, these new objects of war were said to be tanks for carrying water.

In September 1916, approximately one hundred of these tanks were committed in an attack over No Man's Land in the Somme sector. They advanced without support or sufficient training of crews. The entire operation ended in a bloody fiasco. Concentrated enemy fire penetrated hulls and gas tanks.

With the lessons learned in this operation further development and construction were energetically pursued. Finally on 8 August 1918, 456 tanks succeeded in breaking the German lines in an offensive at Amiens. The tank was firmly established as a weapon of war.

Down through the years to the present day the tank has developed rapidly. With its development has sped the parallel development of counter-measures; measures, which boiled down, are fundamentally a problem of guns against armor; armor against guns.

What protection can tankers expect from that mass of steel that is welded and bolted about them? They certainly have a right to expect plenty. They are by no means the smallest target on the battlefield. And so, with this in mind, let's look at the problem of armor against guns to determine the factors involved: What happens, for instance, to armor when struck by modern projectiles designed to penetrate that armor? What happens to projectiles when they strike armor designed to prevent their penetration?

Modern methods of making steel are highly scientific and produce steel of any quality with approximately any degree of these qualities: *elasticity, plasticity, ductility, malleability, brittleness, toughness,* and *hardness.* When considering the protecting steel surrounding the tanker, we are mainly interested in its ability to prevent indentation and penetration. Next in importance is the thickness of the armor; and finally, the angle at which it is tilted from the normal or vertical plane.

The conventional projectiles used against armor are divid-

ed into two distinct types. The first is the solid steel projectile that depends upon its terminal velocity to effect penetration. The second is the high explosive projectile the charge of which is so shaped as to concentrate the heat and explosive force of the charge on a certain spot in front of the round.

In the case of the solid steel projectile, the conditions that have direct bearing on its penetration are its terminal velocity (the velocity of the projectile at the time it strikes the target), its hardness, weight, diameter, length, and shape. On the other hand, the high explosive round with the shaped charge depends for its penetration upon the size of the charge and the accuracy with which the charge is shaped to concentrate its heat and explosive energy on a certain spot. With this type of projectile the terminal velocity must be carefully controlled to avoid shattering the charge before it explodes. This is also true in order to accomplish the detonation at the exact instant when the face of the armor is at the focal point of the explosion.

There is no doubt that armor plate can be constructed of sufficient hardness and thickness to defeat any known projectile that seeks to effect penetration. However, it further stands to reason that, within the bounds of practical use, the loss of mobility through excessive weight and the extreme cost of such armor would be prohibitive. First, therefore, we must concentrate on hardness, which is achieved through certain heat treatment and chemicals. The hardness of steel is measured by various devices. A device commonly used is the Brinell Hardness-Testing Machine. The test hardness of a metal is indicated by a number called the Brinell Hardness Number (BHN). The larger the number, the harder the steel. This hardness number indicates the number of pounds per square inch required to permanently deform the steel. For example: a BHN 712 indicates a steel with strength of 354,000 pounds per square inch to obtain a certain degree of deformation. A BHN 207 indicates a steel with strength of 98,000 pounds per square inch for a certain deformation.

To further develop the requirements for armor protection,

next consider the thickness of a plate. On most modern medium tanks frontal armor varies in thickness from three to five inches. The weight limitations mentioned previously can be pointed out forcefully by considering that one cubic foot of steel weighs approximately 480 pounds. Hence a plate 4 inches thick, 8 feet long, and 3 feet wide, approximately the size of the top frontal plate of our medium tank, weighs a little less than two tons. This figure is quite large when you consider the fact that the bottom, sides, rear, and top must also be protected. *Thus the weight of the armor protecting the tanker must be relatively light* for the combat tank to meet speed, acceleration, and load requirements.

What else is needed, then, to avoid prohibitive weights while still maintaining a high degree of armor protection? The third factor necessary for increased armor protection is the angle at which the plate is tilted from the vertical. This tilt presents more armor to the projectile along its trajectory, and the acute angle between the trajectory and the plate increases the probability of a ricochet. As a result of this tilt the increase in the depth of the armor is called "Armor Basis" (see Figure 1). Hence, a plate 4 inches thick tilted away from the vertical through an angle of 40 degrees, has an armor basis of approximately 5.2 inches. In other words the projectile must now penetrate 5.2 inches of armor. Likewise, the plate tilted at 60 degrees has an armor basis of 8 inches.

There are two types of armor plate that can be used to protect the tanker. One is called Homogeneous armor plate and the other is Face Hardened armor plate. Homogeneous armor is a class of steel plate that is consistently hard throughout. This type has a tendency to shatter under repeated impact, and it will also "spall." The term spall means simply that small pieces of armor are chipped from the plate. (See Figure 2.) This is an interesting and important consideration in view of the fact that spalling will occur *inside* the tank even though a penetration is not made. An average BHN of homogeneous armor is 425.

Face Hardened armor, as its name implies, is not consistently hard throughout. The front face has been so treat-

ed that it is harder than the Homogeneous type, but the hardness throughout the rest of the plate is less. This type of armor offers more protection per pound of metal but it is extremely expensive to make. Its hardened face does much to shatter a projectile at the instant of impact. An average BHN is 500 at the face and 375 at the core.

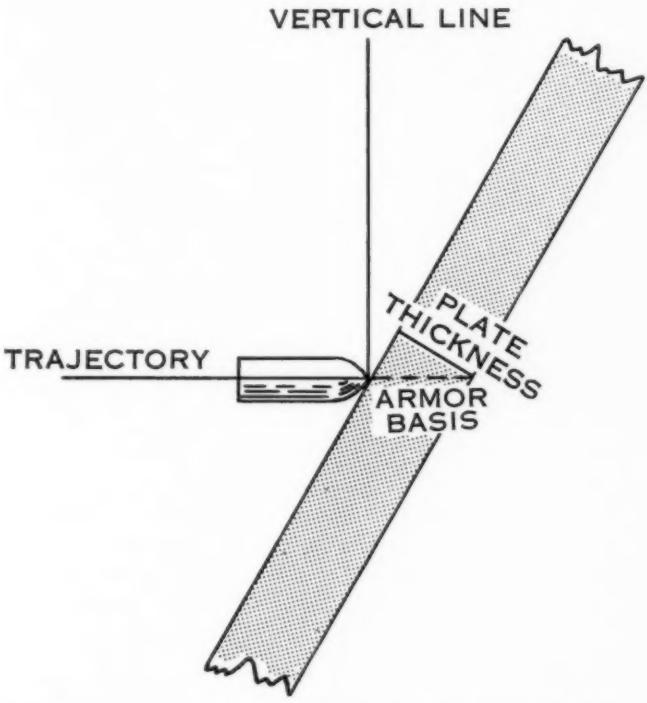

Figure 1. An armor plate, tilted away from the vertical, has a greater "armor basis" than one mounted vertically.

These types of armor are generally what the tanker has for protection. But what of the projectiles that are fired at him, seeking to penetrate the protecting shell of steel? He can find but little consolation in the fact that there are only two general types of these projectiles: the solid steel

armor-piercing type, and the high-explosive antitank type. The first type, as has been pointed out, depends upon the projectile's terminal velocity, hardness, weight, diameter, length, and shape. A complete penetration by this type can be considered as accomplished if any part of the projectile protrudes through the plate or if any hole is made through which light is admitted.

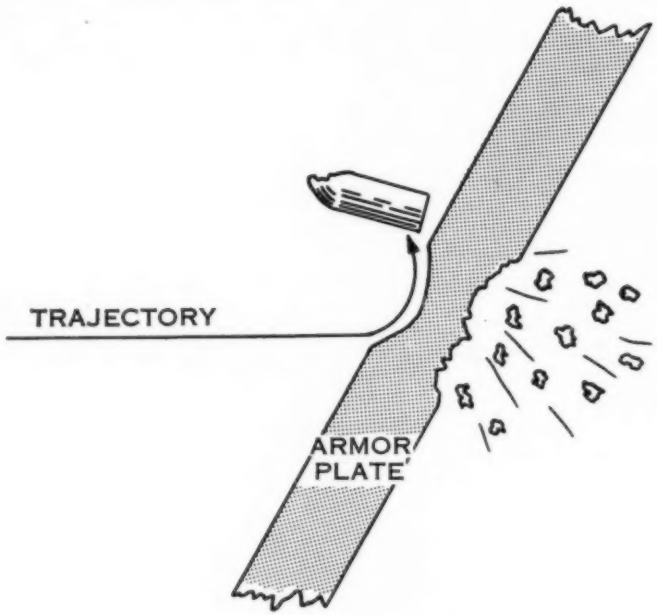

Figure 2. "Spalling"—the tendency of armor plate to be chipped away even when not penetrated by the projectile.

The velocity factor is extremely important. It is interesting to note that penetration is little changed by the material of which the projectile is made (other factors being equal) providing that extremely high terminal velocities are obtained. This phenomenon is sometimes explained by considering a critical velocity at which, and above which, the projectile creates a shearing stress greater than the strength

of the plate. The striking force of a projectile is the most important single factor affecting penetration. To express this force in foot-pounds, multiply the weight of the projectile in grains (W) by the square of the terminal velocity in feet per second (V^2), and divide the product by 14,000 times the acceleration due to gravity (g). Thus:

$$F = \frac{WV^2}{14{,}000g}$$

There are, however, definite limitations to extremely high velocities. Although it is obvious that a simple way to increase the striking force is to increase the velocity, this practice is definitely limited by a positive increase in air resistance. Further limitations are imposed by the increases necessary in gun chamber size in order to obtain relatively small increases in muzzle velocity. This, in turn, imposes the problem of prohibitive gun weights. Furthermore, in extremely high velocity zones, the projectile has a tendency to develop "yaw" as it leaves the muzzle. The yaw of a projectile is the rotating motion which the long axis of the projectile makes around the trajectory, or direction of motion. (See Figure 3.) This can best be demonstrated by holding a pencil at the middle with the thumb and forefinger of one hand and moving the eraser end of the pencil in a circular motion with the other hand. Even a very small amount of yaw will greatly decrease the penetrating ability of the projectile.

The hardness of the steel of which the projectile is made also plays a determining part in the penetration of armor. The projectile must be able to withstand enormous stresses and strains without material deformation during penetration. At high velocities a projectile must remain largely intact to achieve penetration. In some cases of penetration, considerable portions of the projectile are gouged out as it passes through the plate. This materially reduces the penetrating ability of the projectile, since the projectile tends to stick in the hole. Certain projectile designs incorporate a soft base ring of steel which is stripped off if the projectile gets stuck as it drives into the plate. Furthermore, when an armor piercing round strikes a sheet of armor plate the en-

tire energy of the projectile is concentrated at this point. This enormous force is sometimes greater than the nose of the projectile can withstand. It therefore shatters and flattens, greatly reducing the penetrating characteristics of the projectile. To offset this fault, the Armor Piercing Capped round was developed. This projectile is fitted with a harden-

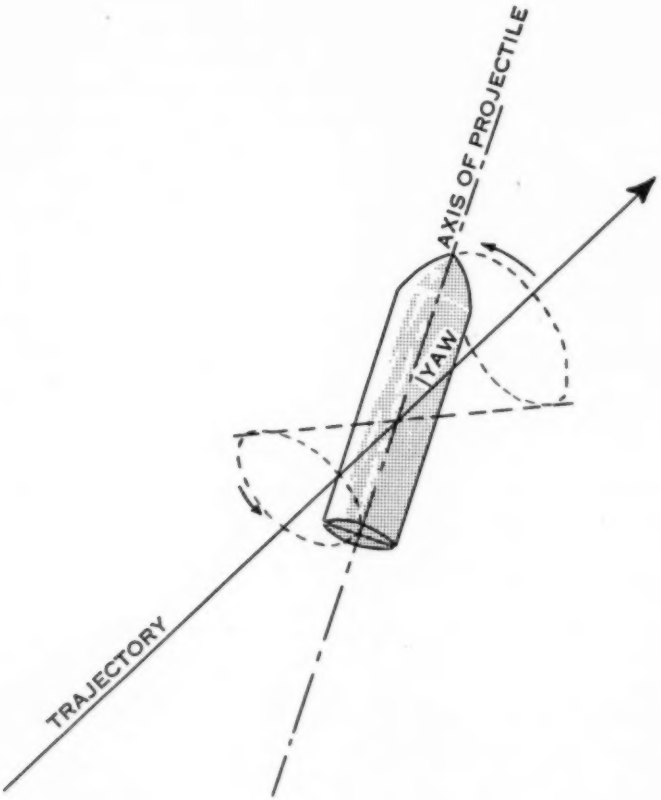

Figure 3. "Yawing"—the motion made by the long axis of the projectile around its trajectory.

ed cap and a ballistic windshield. First the windshield strikes the armor and shatters; then the hardened cap strikes. The tremendous forces of impact act through the cap to severely damage and strain the armor. The cap then breaks up, allowing the undamaged projectile with its hard nose to complete the penetration.

These forces on the nose of the projectile are not the only forces to be contended with. If the projectile strikes at an angle to the face of the plate and begins to penetrate, it has a tendency to right itself and penetrate directly into the plate along the normal or perpendicular line to the face of the armor. This sudden tendency to right itself creates a bending stress in the projectile. Then, as penetration proceeds, the forces of friction between the projectile and the plate tend to turn it back toward the line of fire, creating another violent bending stress. (See Figure 4.) These forces will often cause the projectile to be deeply gouged, deformed, or broken off at the base. As a matter of interest to the tanker, he can expect the 90-mm APC round with a muzzle velocity of 2800 f/s, to penetrate 4.8 inches of armor at 1,000 yards.

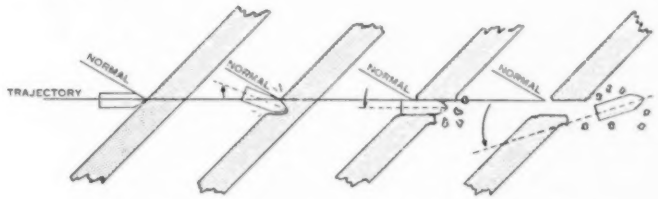

Figure 4. Bending stresses are set up in projectiles that hit nonvertical armor plate.

Reaching up into the higher velocity ranges are the Hypervelocity Armor Piercing projectiles. These projectiles consist of an extremely hard core of tungsten carbide steel. The core is surrounded by an aluminum alloy carrier, on the front of which is fitted a thin metal windshield for streamlining. The very high velocity of this projectile and the extreme hardness of the armor-penetrating core combine to achieve much greater armor penetration. The 90-mm size

in this type of projectile can be expected to penetrate 7.8 inches of armor at 1,000 yards. Its velocity is 3,350 feet per second. At 1,000 yards its terminal velocity is approximately 2,910 feet per second, delivering about 2,200,000 foot-pounds of energy against the armor.

While discussing armor-piercing projectiles it is appropriate to say that the shapes of projectiles that would be most efficient in penetration are not always the shapes which afford the best ballistic characteristics in flight. This limits, to a certain degree, any radical change in future armor-piercing projectiles.

The second major armor penetrating type of projectile is the high explosive antitank type, (HE, AT). *While the projectile itself does not penetrate the armor,* this type is even more effective than the solid AP type. The explosive force is concentrated at a small point on the face of the armor. Its intense heat is sufficient to melt the armor. Upon melting it is blown through the plate by the explosive force. The perforation thus created is not large, but small pieces of molten metal from the perforation are driven about in all directions inside the tank, with great casualty producing effect.

The construction of this projectile is simple. Enclosed in a thin steel casing is the high explosive charge. The front of this charge is shaped in the form of a concave cone. This shaping directs the force of the explosion to the front and concentrates it at a point a certain distance ahead of the base of the cone. This distance is called "stand off." The charge is detonated by a base detonating fuze which activates when the ballistic windshield strikes the armor. (See Figure 5.) The windshield is so made that it causes the charge to burst within the optimum "stand off" for maximum effect. If the charge bursts too late or too soon its effect is lessened. This necessitates careful regulation of the striking velocity to prevent the shattering of the charge before detonation and to prevent late or premature detonation. These projectiles are either fin stabilized or spin (rotary) stabilized. The fin stabilization is the most effective because, unlike the spin stabilized projectile fired from

a rifled gun, there is no rotation to scatter and diffuse the blast. Even the small rifle grenade, which is fin stabilized, will penetrate 3 inches of homogeneous armor. Compare this with the spin stabilized, larger, much higher velocity 57-mm rifle HE, AT projectile which will penetrate only one-half inch more of armor. Even more impressive is the 11 inch penetration of the 3.5 inch rocket.

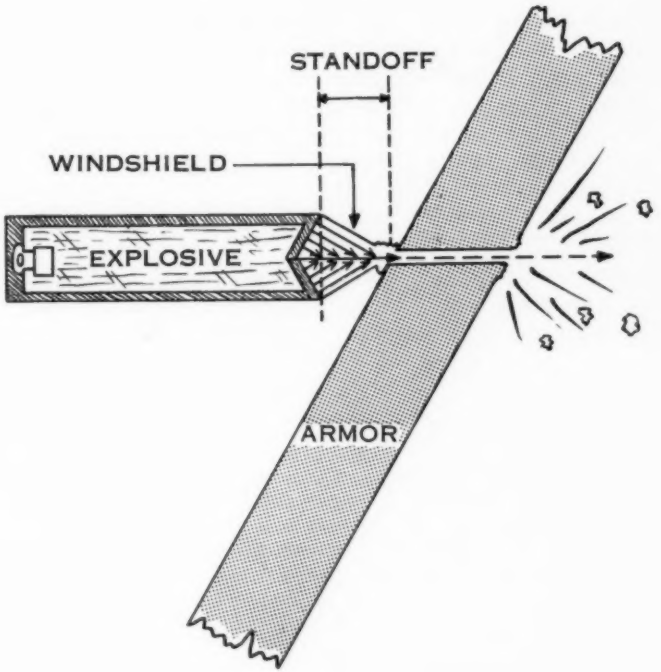

Figure 5. The High Explosive-Antitank projectile has a shaped charge that is detonated when the ballistic windshield strikes the armor.

From the discussion so far, what is desired? More armor? Hardly. But armor with greater obliquity, more tilt, is highly desired. Let's have more ricochets and fewer penetrations from attacking projectiles. Perhaps there can be

concocted a tougher, harder armor that is still within weight and budget requirements. But what budget is worth five tankers? It might be very effective to have armor of certain alloy constituents or chemical and physical properties with an extremely high melting point. Perhaps such armor would defeat the HE, AT projectile; or perhaps other materials such as glass, asphalt, or high per cent carbon alloys might nullify the HE, AT projectile.

What of projectiles? The effective limit of solid armor-piercing projectiles, fired from conventional guns, is rapidly being reached. HE, AT projectiles with high explosives and greater range are being made. But with increase in these factors comes greater weight and with greater weight comes less mobility. Wars of today and tomorrow are and will be lightning fast. With more speed there are more misses. *If* the tank is hit, will it be penetrated? Perhaps. *If* it is hit in the right place, *if* it is hit by the right projectile, *if* it is hit at the right angle, *if* it is hit at the right velocity under favorable conditions.

Towing Ski-Troops **by Major Ingebrigt Solum. The author, a Norwegian Army officer, is the Executive Officer of the Norwegian Infantry and Winter Warfare School. His article discusses how the inherent mobility of ski-troops is enhanced by towing behind vehicles. Read this article in the October QUARTERLY.**

Letters to the Editor

I wish you'd devote more space to tactical articles—new thought and techniques on this subject. Don't get me wrong, I think you've got a fine publication, but if most of your readers are like me (a platoon leader) they want plenty of the latest tactical doctrine. I particularly like your problem articles because they are adaptable to field training. More tactics, please.

Sincerely,

Lieutenant, Infantry.

We agree with you, Lieutenant, and we think you'll agree with us when you get your future issues of THE INFANTRY SCHOOL QUARTERLY. In this July issue you'll find three down-to-earth tactical articles, including two problems.

Reference article "The New Airborne Division" in the April 1950 issue of your excellent publication, THE INFANTRY SCHOOL QUARTERLY.

The text pertaining to the AAA (AW) battalion refers to four (4) automatic weapons batteries while charts V and VIII indicate personnel and equipment for only three (3) such batteries. Would you kindly inform me which is correct?

Major, Infantry.

Thank you for calling to our attention the errors which appeared in our April issue of the QUARTERLY.

The text is wrong; the chart right. There are only three automatic weapons batteries in the AAA (AW) Battalion in the new airborne division.

I enjoyed reading your humorous article, PREPARED FOR INSPECTION, in your April issue. The author makes his point well, but I think the point is out of date. At least it is in my outfit. We don't have a lot of time to get ready for an inspection; in fact, we never know when one is coming up. This keeps everyone on his toes, and there is no last minute "cramming" to outguess the inspector.

Infantry Captain.

Apparently your outfit is as it should be in this regard. That was the author's point.

Wanted: Realism in Weapons Marksmanship Training **by Capt John R. Flynn. In plain language, the author tells what he thinks is wrong with our present marksmanship training—a thought provoking article coming in the October QUARTERLY.** ***(The Infantry School disagrees with the author and states why in a rebuttal.)***

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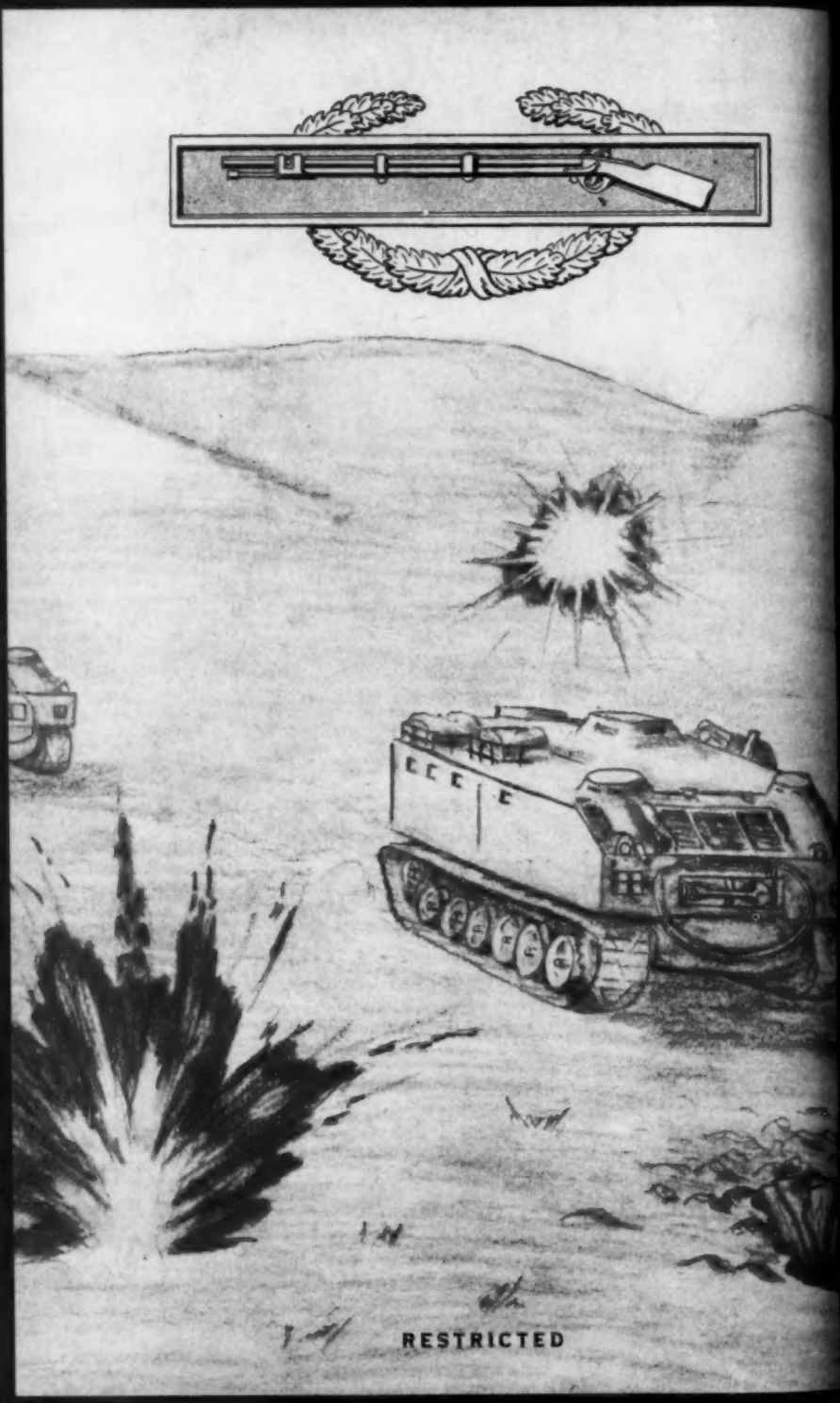

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